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Philippe BLANCA
Born on 22 February1970 in Châtillon sur Chalaronne (France)

THE SCIENTIFIC JOURNAL IN THE AGE OF DIGITAL MULTIMODALITY

Dissertation defense committee

Dr Ch. Max, Dissertation supervisor
Professor, Université du Luxembourg

Dr Ch. Schommer, Chairman
Professor, Université du Luxembourg

Dr P. Hitzler, Vice-chairman
Professor, Write State University, Dayton, USA

Dr G. Kress, Committee member
Professor, University of London

Dr P. Caire, Committee member
Professor, Université du Luxembourg

The Scientific Journal in the Age of Digital Multimodality

Preface

It is common to compare the process of completing a PhD dissertation with a journey. This is no different in the present case. From a personal point of view, this dissertation is an attempt to put together ideas and experiences coming from various contexts I was involved in over the past 15 years. In particular, my involvement as a member of the editorial board of the French multidisciplinary journal *Le Croquant* founded by Prof. Michel Cornaton in 1987 is pivotal. The present work is also the result of reflections related to readings in various domains (from poetry and literature to social sciences and philosophy) and discussions in connection with the organisation of scientific conferences fully integrating artistic events, such as music concerts, painting exhibitions and plays. Finally, these pages are the result of a long process of transformation of an initial question that has arisen from lively discussions and debates with friends – each of us, according to her or his preferences, celebrating or defending the unique values of words, sounds, drawings, images or photographs etc.

The substance of that initial question was formulated in the kitchen of a small apartment in Paris more than ten years ago: how is it possible to use both words and images in such a way that words are not perceived as a legend of a picture or conversely in such a way that images are not approached as a mere illustration of the textual part of a document. If that question can obviously be broadened and includes sounds, colours and other modes of communication, I would first like to emphasise one point: after spending months trying to deal with issues linked to multimodality, I came to the conclusion that, except in specialised circles, the question of the interplay of semiotic resources in a multimodal composition tends to be oversimplified due to the abundance of visual and aural distractions resulting from the daily use of social media and other multimedia tools. Multimedia, from our viewpoint, is often the tree hiding the forest of multimodality and its concrete enactment in formats that are still in an experimental stage, especially regarding scientific publishing.

This work is fully original and has not been subject to other forms of publication, except a conference paper that appeared in the proceedings of the 6th international symposium on genre studies (Blanca 2011). Large parts of this

dissertation, however, have been discussed at various stages of its drafting, particularly with my supervisor Charles Max who gave me the opportunity to develop and complete this research project. It goes without saying that the former DICA research group and its members provided a disorienting but always stimulating forum of discussion: by convening people with different academic and professional backgrounds from many horizons, it has contributed to make some of the statements of that work more substantive. I do not to forget the members of my supervisory committee – Gudrun Ziegler, Pascal Hitzler and Christoph Schommer. Each of them stimulated me in their own way to make significant parts of this dissertation more explicit.

A dissertation is the result of a complex network of influences that are sometimes difficult to capture precisely. The title of this work echoes the title of a previous study published in 2007: *The scientific article in the age of digitization* (Owen Mackenzie 2007). Long discussions with Markus Molz have had a deep impact on some of the views and arguments that I explore in this work. Natalia Duruš has expertly contributed to improve my English – though any remaining imprecision and vagueness are exclusively mine. My colleagues Ju-youn Song, Claudia Albanese and Susanne Backes have been my daily energy. At another level, colleagues from the Faculty or from other universities have provided meaningful insights, sometimes without even realizing it. A series of lectures organised in 2012 within the context of the former LCMI research unit about multilingualism and multimodality have allowed me to meet researchers in person whose work has been of direct benefit to these pages: thanks to Ingrid de Saint-Georges, they are no longer mere references in a bibliography.

One of the first challenges to be met in the process of completing this research was to find appropriate candidates that corresponded - to plagiarise the title of a book – to what I was talking about when I was talking about multimodal scientific journals. Despite very busy agendas, a few editors and managing editors of the still few existing multimodal academic journals accepted to answer some of my questions, in particular Cheryl E. Ball (*Kairos*), Moshe Pritsker (*JoVE*), Jesse Pearlman Karlsberg (*Southern Spaces*). I consider that they belong to a handful of individual representatives who are acting as cultural change agents.

They contribute to promote multimodal scholarly publishing and to make it a tangible reality, in full respect of scientific requirements and standards, as they explained to me in detail.

Finally, the University of Luxembourg with its mixture of multiculturalism and multilingualism - from the official French, English and German to the national Luxembourgish, without forgetting the Portuguese - has turned out to be a perfect place to explore the multiple modes of communication and multimodality. I am grateful to have been given the opportunity to undertake a research project in such an environment thanks also to dedicated people taking care of daily needs and allowing me to keep my feet on the ground while I was dealing with the conceptual subtleties.

I will not forget that this work would not have been possible without the precious presence and support of family and friends.

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Introduction

During a workshop organised by the former LCMI research unit of the University of Luxembourg, when asked about the current possibility not only to provide multimodal analyses but also to practice multimodal publishing – that is, to publish works that combine a variety of semiotic resources beyond written words, static images, graphs and tables –, an expert in social semiotics chose first to reaffirm in his answer the effectiveness and the efficiency of written words rather than promoting multimodal scientific publishing. While it goes without saying that written words play a powerful role when it comes to publishing, this answer was somewhat surprising. Indeed, if just for one moment we consider poetry as a field that makes use primarily of written words and questions the power of language, the precise opposite attitude seems to prevail throughout the twentieth century: most of the time, it is remarked that written words fail to express thoughts, feelings and emotions – and to convey adequately an experience. Beyond the anecdote, opposing in this way both science and poetry helps capturing a pervasive attitude within the scientific community: despite the broad range of opportunities the digital technologies made available to the many, despite a growing number of research studies dedicated in particular to visual communication and data visualisation, written words among scholars seem still to be considered the mode of formal dissemination of research findings *per se* and moreover the mode around which other modes of communication are supposed to be organised.

Bringing together multimodality and scientific publishing raises concerns thus and in first place about scientific attitudes towards words. However, what could be interpreted sometimes as forms of logocentrism in research (see for instance Chang 2000) reminds us indirectly that multimodal publishing is also a challenge that presupposes unlearning of a variety of deeply ingrained habits. A personal attempt to submit a multimedia abstract of a contribution to a scientific journal has proven to be significant from this point of view: multimodal composing – thinking through different modes of communication in combination – disrupts

the established ways of meaning-making-by-writing. Written words no longer play the role of an orchestra conductor. There is no longer only one but a diversity of reference points to be taken into consideration: writing becomes designing a complex ensemble (Kress 2009). The first habit to unlearn is then related to literacy and implies an approach in terms of multiliteracy (Duncum 2004).

The second habit to unlearn is a certain separation on which social research in particular is usually based between cognitive processing and the senses (Laplantine 2005) in relation to the process of meaning making and to knowledge production. *Pre-text*, *con-text* and *para-text* are three notions, among others, that particularly mimic a common practice consisting in confining everything that does not belong to written or spoken language ("everything that surrounds a strip of talk", Norris 2004:101) to the domain of the so-called "non-verbal" communication, or more generally to “the environment”. Current digital technologies enable the possibility to make use of a wide range of semiotic resources beyond language that fully participate in the process of meaning making and knowledge production but were excluded from printed publications for technical reasons. It can be argued from this point of view that digital technologies offer an opportunity to approach the relationship between knowledge and semiotic resources, meaning making and the senses in a renewed manner. Making meaning is nevertheless more than multimedia integration (adding a video or embedding sound in a web page). What would be then, in the age of digital multimodality, some of the characteristics of pieces of work that communicate the "beautiful evidence" (Tufte 2006) besides the factual evidence? In a complementary manner, what would be some of the essential features of a publishing environment disseminating articles of high scientific standards in ways that go beyond "print forms of knowledge" (Palmeri 2012:158) still predominantly reproduced in a large majority of online scientific journals today? Finally, what would be the added values of multimodal publishing for the scientific community at large?

To answer these questions, this dissertation studies a few examples of existing online scientific journals allowing researchers to disseminate articles based on a

digital, multimodal format. As already suggested, the whole process of multimodal publishing involves numerous cultural, social and systemic factors that require un- and relearning a number of habits. Some of those factors are investigated in the present work by reanalysing the research process ("do research, communicate and apply the results", Björk 2007:12) and especially by revisiting the four conventional phases of the scientific publishing cycle (composition/submission, evaluation, dissemination and consumption).

This exploratory study aspires to bring two realms closer to each other: multimodality on the one side and scientific publishing on the other side. Three elements indicate that those two realms are still rarely approached in combination. First and at the risk of oversimplifying, research mostly uses multimodality as a theoretical framework (and this work is no different from this point of view) to analyse a posteriori practices, events or products in different contexts (a classroom, a workplace…), to a lesser extent turns multimodality into a formal publishing practice. Second, the relative lack of literature focusing specifically on multimodal scientific publishing (see 1.2) is not compensated, from an empirical standpoint, by a large number of existing multimodal scientific journals that disseminate, on a regular basis, articles based on a multimodal formats (see 4.2.1). Finally, due to the fact that online publishing and dissemination is still relatively new in comparison to hard-copy distribution, practices are still understood, in the background, in relation to written words and print technology. In consequence, concepts and notions often fail to convey what is exactly at stake in relation to multimodality. An article published online, for instance, is no longer a "paper" but is not yet fully and unambiguously recognised as a webtext, among other denominations (Ball 2012:61). If quoting, second example, translates the process of extracting written words and a content only from an article then quoting does not exactly describe the process of pointing to what is defined in this work as a multimedia artefact (see 1.1). More simply, we have not been able to find a single article "quoting" precisely an excerpt from a video, used as a theoretical reference and not as data, as it is commonly the case for a chunk of text. In sum, conventions regarding quoting and other obvious tasks linked to scientific publishing in journals (from submitting, reviewing and revising, to indexing and commenting etc.) still need

to be re-defined and practiced in relation to sound, video and other semiotic resources.

The general organisation of this dissertation is deduced from the foregoing points. The first chapter gives an overview of the research endeavour and the equation (digital multimodality + scientific publishing = ?) that it aims to solve (1.1) from a theoretical (what does multimodal scientific publishing mean?) and from an empirical point of view (what does a multimodal scientific journal look like?) (1.2 and 1.3). The methodology used to analyse existing scientific journals allowing researchers to publish articles based on multimodal formats is then introduced (1.4). Once the overall canvas of the thesis is drawn, we define in the two subsequent chapters, what multimodal scientific publishing is, situating this emerging field at the crossroads between four research areas: social semiotics and composition on the one hand, genre studies and information studies on the other hand. The second chapter in line with this intention is dedicated to the 'digital multimodality' term of the equation and contextualises the undertaken exploratory study in relation to composition studies (2.1.) and social semiotics (2.2). The third chapter explores genre studies (3.1) and information studies (3.2 and 3.3) in order to circumscribe the 'scientific publishing' term of the problem. The dividing line between the two sides of the equation presented in this work is open to discussion. In our understanding, though, it can be broadly summarised in the following way: social semiotics and composition studies mainly tend to approach multimodality as a project whereas genre studies and information studies focus on multimedia and then tend to approach multimodality as an object.

In marked contrast especially to scientific data visualisation that have receive increased attention in recent years by both scholars and practitioners, multimodal scientific publishing does not yet seem to be widely recognised as a worthy area of study. This situation is slowly evolving thanks to a handful of researchers acting often at the same time as editors of multimodal scientific journals and as promoters of multimodal publishing for scientific purposes. All of these various editorial initiatives drive this field forward in practice. In chapter four, concrete examples of existing scientific journals providing semiotic

resources beyond text and static visuals are thus investigated. The empirical analysis (Chapter 4) is first introduced by a summary review of all the conceptual tools collected in the theoretical chapters (4.1). The empirical analysis is then conducted through two interrelated phases. The first phase is dedicated to analysing the editorial policy of a sample of 38 journals in relation to multimedia integration – a necessary, but not sufficient, condition for multimodal publishing (4.2). The comparative case studies, based on a method called general morphological analysis or GMA (Ritchey 2011), performed in the second phase (4.3), is aimed to identify actual options for multimodal scientific publishing through the examination of four representative journals selected from the initial sample. The solution space resulting from the empirical analysis is eventually interpreted as a set of potential solutions to the equation placed at the core of the present work and initially solved in chapter two and three from a theoretical point of view. In chapter five, the most prominent characteristics that multimodal scientific journals share, as inferred from previous theoretical considerations and empirical results, are gathered into a whole conceived as an activity system that allows systematic investigation of online scientific journals or other scientific publishing environments with any multimedia content or semiotic resources (5.1). Some of the implications of multimodal approach to scientific publishing regarding the notion of scientific journal and the generation and dissemination of research findings are illustrated through a short case example (5.2). Finally, the main findings and the contributions of the present study to scientific publishing are outlined in the conclusive chapter of this work.

NOTE: In this work, references given in brackets in the form of acronyms, written in capital letters, correspond to the website of a journal or other types of publishing environments (such as blogs, aggregators, repositories etc.) listed at the end of this work (see 'Websites and webpages' under References). In some cases, a reference to a publishing environment is complemented by a keyword written in small case letters (such as "About", "Submission" etc.) in order to indicate a specific location (section or page) inside a website.

1. Multimodal scientific publishing: An Equation to Solve

The undertaken research aimed to bring together two topics that are still seldom discussed in connection with one another: multimodality and scientific publishing. A major reason for this lack of research is that the terms *multimodality* and *multimodal* are overshadowed, in most of the literature dedicated to scientific publishing, by the term *multimedia* on the one side, and by the term *digital* on the other side. More than a mere question of vocabulary, it seems that studies related to multimedia content in scientific journals, generally speaking, fail to grasp at the same time the specifics of a multimodal approach to scientific knowledge production and dissemination. Multimodal publishing is therefore regarded as multimedia content integration and multimedia is in consequence approached either as just one digital characteristic of online journals among others, or as a side issue in comparison to other topics much more broadly addressed and discussed, such as open access publishing and the peer-review system.

In this chapter, all these points are covered in detail and integrated as different parts of a coherent research approach. After a terminological clarification, the research purpose is specified in form of an equation to solve (1.1). Based on this equation, the second section serves to situate the present research endeavour in relation to existing research fields (1.2). The research problem and the research questions are then introduced (1.3). In the last section, the methodology used in this work is presented (1.4).

1.1. Definition of Key Terms and Research Purpose

The present exploratory study focuses on scientific journals that allow contributors to publish articles based on multimodal formats and eventually to disseminate scientific multimedia artefacts. As can be immediately noticed, two apparently similar terms are used in the previous sentence, "multimodal" and "multimedia". A clarification of the differences and the connections between the

notions of *multimodality* and *multimedia* is therefore of key importance for the understanding of this work.

Following Lauer in her attempt of "contending with terms" (Lauer 2009:225), in this research, *multimodality* is used in the context of publishing processes to denote activities of composition unfolding in time that combine a variety of modes (such as textual, pictorial, oral, including paraverbal) to communicate. *Multimedia*, in contrast, refers to the product, the deliverable artefact that can be archived, disseminated, as well as its components – that is its semiotic resources or means to make meaning (such as text, images, videos, animations, audio-files and interactive virtual models).

Lauer (2009) contextualises these two concepts in the following way:

> While "multimedia" is used more frequently in public/industry contexts, "multimodal" is preferred in the field of composition and rhetoric. This preference for terms can be best explained by understanding the differences in how texts are valued and evaluated in these contexts. "Multimodal" is a term valued by instructors because of its emphasis on design and process, whereas "multimedia" is valued in the public sphere because of its emphasis on the production of a deliverable text (Lauer 2009:225).

Process and product are evidently closely linked to each other, given that there are also intermediate multimedia artefacts that serve further multimodal composition and given also that the final packaged multimedia product contains many indicators of the multimodal composition process. At the same time there are also many aspects of the composition process that are not reflected in the multimedia product, i.e. that cannot be retraced based on the artefact alone. The multimedia product eventually also has "a life of its own", as the way it spreads, the way it is used and recompiled can go far beyond the intentions the author was animated by in the process of producing it. Lauer (2009) makes this point in the following way:

> Multimedia is used to describe texts whose worth is determined by their successful production and distribution, not by the process an author took to compose them. Multimodal, on the other hand, is regularly used to characterize

> the cognitive and socially-situated choices a student or scholar makes while in the process of composing a text, before it enters into final production and distribution (Lauer 2009:236).

Depending on the perspective taken there is both a relative interdependence and a relative independence of the multimodal publishing process on the one hand, and the disseminated multimedia product on the other hand, including its underlying data sets, databases, algorithms and software programmes, as well as the hardware that is used to run the respective software and display the multimedia objects.

To sum up, in this study, the term "multimodal" is used in relation to composing and evaluating a scientific article, hence "multimodal scientific publishing". The term "multimedia" is used in relation to archiving, disseminating and consuming a scientific article, hence the notion of "multimedia artefact". Multimodal publishing is a prerequisite for multimedia artefacts to come into existence whereas existing multimedia artefacts serve either as tools or semiotic resources for multimodal publishing. There is nevertheless a difference between a scientific journal disseminating multimedia content (a video for communication purpose for instance or a video abstract presenting an upcoming work) over the Internet and a multimodal scientific journal that make use of various semiotic resources for meaning making.

First and foremost a multimodal journal, in contrast to a scientific journal with multimedia content, is based on a multimodal scientific paradigm (see 4.1 and 5.1). This means that in such a journal, all the activities performed during the key phases of the scientific publishing cycle (composition/submission, evaluation, dissemination and consumption) are understood, defined, described and enacted in relation to multimodality. More precisely, a multimodal scientific journal publishes articles based on a multimodal format, that is to say a format that is intended to encourage (or force) contributors to make use of a variety of semiotic resources – beside the conventional written words, static images, graphs and figures – for scientific purposes.

In sum, in this work, are distinguished three categories of online scientific journals: a) (online) scientific journals that deliver conventional (in terms of semiotic resources used) scientific articles based mainly on written words and static visuals, b) (online) journals with multimedia content (e.g. video, 3D structure etc.) or multimedia journals – for instance with a specific section devoted to disseminate videos, and c) (online) multimodal journals *per se* that disseminate peer-reviewed multimedia artefacts (made up of multiple semiotic resources or means for meaning making) that meets scientific requirements and standards. This last category is the focus on the proposed analysis that does not differentiate, for convenience purposes, between academic, scholarly and scientific journals on the one side, and between online, digital and electronic journals on the other side.

On the basis of the previous terminological clarification, it is now possible to say that the purpose of this exploratory study is about analysing and solving the following equation:

Digital multimodality + scientific publishing = ?

In other words, the object of the present study is to understand how scientific knowledge is generated in light of multimodal approaches to online scientific publishing and to investigate the specific challenges (in terms of opportunities and constraints) it poses to switch from publishing mainly written articles to disseminating multimedia artefacts or scientific knowledge objects (Casati et al. 2007) relying on multimodal formats.

Nevertheless, if the scope of this work can be broadly defined as exploring and defining the specificities of multimodal scientific journals, a number of key themes related to multimodal publishing are not comprehensively articulated in the present study:

- Multimodal composition methods and techniques used to design concretely (see Ball 2012) a scientific multimedia artefact are not analysed in these pages, in spite of their practical importance. Indeed, the focus is more on

editorial policies and the possibilities that the journals under discussion offer rather than on the actual practices of the researchers that make use of these journals to publish their work.

- The "multimodal revision techniques in webtext" (Ball 2013), that is to say the actual interactions taking place between authors and the editorial staff during the production process of a scientific multimedia artefact, are not discussed. Such an analysis would have required extensive data gathering and in-depth interaction – all of which was not possible in the context of this research.
- Authoring and publishing platforms or tools, such as SCALAR (*The Alliance for Networking Visual Culture*) (SCALAR n.d.), multimodal interfaces (see for instance Dumas et al. 2009) and other ICT related issues are mentioned where pertinent, but no systematic comparative analysis of the technical features of multimodal publishing could be undertaken.
- Research practices in mediated settings, "researchers' blogging practices" (Kjellberg 2014:36), online collaboration – and more generally scholarly practices linked to virtual ethnography (Hine 2000), eResearch and eScience (see Beaulieu and Wouters 2009 for this distinction) are insufficiently explored in relation to multimodal approaches to research.
- Finally, disciplinary differences in publishing practices and in relation to multimodality are not enough taken into consideration when analysing journals. Due to the small numbers of existing journals based on a multimodal publishing paradigm (see 4.1 and 5.1), this work does not address such questions as: which are the scientific domains that are most advanced in relation to multimodal publishing? Is it possible to differentiate between different approaches of multimodal publishing according to scientific disciplines and disciplinary traditions?

As can be deduced from the equation (digital multimodality + scientific publishing) used to summarise in a metaphorical way the purpose of this exploratory study, the overall domain of interest of this work covers four interrelated topics. These four topics are the following: 1) multimodality (sometimes confused with multimedia, see 1.1); 2) digitality or digitization (Mackenzie Owen 2010 uses both terms interchangeably) with three relevant

adjectives: digital, electronic and online, 3) scientific research and 4) publishing. In the next section, and before presenting the primary research questions that this work addresses (1.3), the two terms of equation presented are situated in relation to existing research fields.

1.2. Situating the Study in the Research Landscape

This section is aimed first to situate the present work in the research landscape and second to provide a tool for navigating through this study.

The four key topics (multimodality and digitality, scientific research and publishing) considered in this dissertation have been associated and paired in different ways in the literature. It is possible to find studies dedicated to "multimedia scholarship" (Anderson and McPherson 2011:136; Barish and Daley 2005:129), multimedia scientific publication (Ackerman and Redmond 2011:n.pag.), digital scholarly publishing (McCormick 2010:n.pag.) or even "multimedia digital scholarship" (Jakubowicz 2007:n.pag.) and "online multimedia scholarly publishing" (Anderson-Wilk and Hino 2011:n.pag.). Overall, a review of the relatively sparse literature that comes closest to what is eventually defined in this work, as "multimodal scientific publishing" seems to fall into various categories which are not connected to each other.

A first category is about online or digital scientific journals and therefore associates mostly two topics: "digitality" and "scientific publishing". This category covers studies that describe the main features of online scientific journals. Within this context, multimedia is understood as one feature among other digital features. These studies are not based on a multimodal approach to scientific publishing. It can be argued that they do not regard multimodal publishing as posing specific challenges. Five studies I could detect are part of this category:

Mackenzie Owen	2010	The scientific article in the age of digitization
Córdoba and Coto-Solano	2008	Characteristics shared by the scientific electronic journals of latin america and the caribbean
Mayernik	2007	The prevalence of additional electronic features in pure e-journals

Simeão and Miranda	2004	Comunicação extensiva e o formato do periódico científico eletrônico
Treloar	1998	Hypermedia online publishing: the transformation of the scholarly journal

A second category includes studies focusing, on the one hand, on the scientific article and its evolution as regards multimedia integration, and on the other hand, on describing new scientific genres or formats taking advantage of the affordances of the web. Multimodality and digitality as well as multimodality and multimedia are not clearly distinguished in this category that associates mostly, as it is the case for the first category "digitality" and "scientific publishing":

Breure et al.	2011	Rich internet publications. show what you tell
Jankowski	2011	Enhancing scholarly publishing in the humanities and social sciences innovation through hybrid forms of publication
Pettifer et al.	2011	Ceci n'est pas un hamburger. Modelling and representing the scholarly article
McCormick	2010	Digital scholarly publishing: innovative publishing services for NYU
Anderson	2009	Regeneration. Multimedia genres and emerging scholarship
Shotton	2009	Semantic publishing. The coming revolution in scientific journal publishing

A third category is about issues regarding how a scientific article incorporating multimedia components could be assessed. In this category, the multimodal composition methods and technics used to design a multimedia artefact for scientific purpose are studied. "Digital multimodality" and "scientific publishing", in this case, are more explicitly connected but mostly in relation to the dissemination phase of the research process. In other words the focus is on "digital writing" and "multimodal composing":

Ball	2013	Multimodal revision techniques in webtexts
Ball	2012	Assessing scholarly multimedia. A rhetorical genre studies approach
Smithies	2012	Evaluating scholarly digital outputs. The six layers approach

A fourth category is linked to a systemic approach regarding digital publishing in scientific journals. Here again, digitality and multimodality are not always

clearly distinguished. This category includes essays or reconstruction works. These studies are dedicated either to evaluating the quality of scientific multimedia artefacts in relation to scientific standards, or to reflecting on multimedia scholarship:

Jankowski and Jones	2013	Scholarly publishing and the internet: a NM&S themed section
Kress	2012	Researching in conditions of provisionality: reflecting on the Phd in the digital and multimodal era
Presner	2012	How to evaluate digital scholarship?
Shotton	2012	The five stars of online journal articles. A framework for article evaluation
Anderson-Wilk and Hino	2011	Achieving rigor and relevance in online multimedia scholarly publishing
Anderson and McPherson	2011	Engaging digital scholarship. Thoughts on evaluating multimedia scholarship
McPherson	2010a	Scaling *Vectors*. Thoughts on the future of scholarly communication
Meredith	2010a	Explaining research. Explaining research: how to reach key audiences to advance your work.
Jakubowicz	2009	Beyond the static text. Multimedia interactivity in academic journal publishing in the humanities and social sciences (not) [sic]
Borgman	2007	Scholarship in the digital age: information, infrastructure, and the internet
Barish and Daley	2004	Multimedia scholarship for the twenty-first century
Lemke	1998	Multiplying meaning. Visual and verbal semiotics in scientific text
Eason et al.	1997	A comparative analysis of the role of multi-media electronic journals in scholarly disciplines
Hammond and Shipley	1994	Considerations for the use of multimedia with scientific and technical information. A case study

A last category brings together scientific research and digitality. eResearch, eScience as well as digital ethnography or virtual ethnography seem to represent different variations of two continuously interrelated and intertwined programmes: the first is about conducting online research and approaching the Internet as a field, a territory or a variety of cultures that can be investigated, observed and analysed. Beaulieu talks in that case about the "ethnographies of the Internet" (Beaulieu 2004:139). The second programme is about using the affordances of the Internet in order to conduct, for instance, social research

(Murthy 2008) that profits from these new possibilities. In both cases, it is argued that publishing, in this perspective, is about "[making] available not only research conclusions but also the detailed research process that undergirds this conclusion" (Spiro 2007:n.pag.). In sum, communicating research is more than online dissemination but implies by ricochet experiencing and experimenting new digital formats, forms or genres. This aspect eventually leads to asking new types of research questions. It is worth mentioning here that a majority of works dedicated to eResearch does not identify (multimodal) social semiotics as a field that provides conceptual tools for understanding critically how Internet, multimedia/digital technologies are changing the way scientists conduct research.

Markauskaite	2010	Digital media, technologies and scholarship: some shapes of eResearch in educational inquiry
Murthy	2008	Digital ethnography. An examination of the use of new technologies for social research
Jakubowicz	2007	Bridging the mire between e-research and e-publishing for multimedia digital scholarship
Jankowski	2007	Exploring e-Science: an Introduction
Spiro	2007	Doing digital scholarship
Beaulieu	2004	Mediating ethnography: objectivity and the making of ethnographies of the internet
Beaulieu et al.	2001	Messy shapes of knowledge – STS explores informatization, new media and academic work
Hine	2000	Virtual ethnography

As the previous tables show, there are no clear-cut divisions between the aforementioned categories and some works should be integrated in two or more categories. Four main orientations seem to emerge nonetheless from the ways some of the key topics, discussed in the present work, are associated in these categories. In each orientation, the focus is on the result of an association between "digital multimodality" and "scientific publishing", that is to say the multimedia artefact: a) The 'composition studies' orientation (mainly the third category above) is about composing or designing a multimedia artefact for scientific purposes based on a multimodal format. b) The 'social semiotics' orientation (mainly the previous third category and part of the fourth category)

is about reflecting on multimodal approaches to scientific publishing. It is about interpreting a multimedia artefact from the viewpoint of its multimodal approach. c) The 'genre studies' orientation focuses on the scientific article genre (it includes works mainly from the previous second and the third category). In this case, the functions of a multimedia artefact are under scrutiny. d) The 'information studies' orientation is a systemic approach and is an attempt to understand how a multimedia artefact is or could be disseminated. Each of these four main orientations, in other words, help to identify the major issues linked to composing, evaluating, disseminating and consuming a scientific multimedia artefact.

On this basis, it is now possible to situate this work at the crossroads of four research areas (composition studies and genre studies, social semiotics and information studies), that is to say in an emerging research field – multimodal scientific publishing - that connects digitality and multimodality, research and scientific publishing. Multimodal scientific publishing aims to address practical and theoretical questions on how scientific knowledge is produced, evaluated, disseminated and consumed in the age of digital multimodality. This definition is a mash-up bringing together three references or voices: 1) *Multimodal scientific publishing* is derived from Tara McPherson's sentence: "This brown-bag workshop will address practical and theoretical questions regarding approaches to multimodal scholarly publishing" (McPherson 2012:n.pag.). 2) *Produced, evaluated, disseminated and consumed* is borrowed from a study published by Fabio Casati, Fausto Giunchiglia and Maurizio Marchese: "Liquid publications: scientific publications meet the web. How scientific knowledge is produced, evaluated, disseminated and consumed" (Casati et al. 2007:n.pag.). Finally, 3) *in the age of digital multimodality* echoes the title of John Mackenzie Owen's book: *The scientific article in the age of digitization* (Mackenzie Owen 2010).

Before describing the methodology used in our analysis of multimodal journals (1.4) and in order to formulate the research questions which guide this work, in the next section, the initial equation (digital multimodality + scientific publishing) to solve is revisited and put in perspective in relation to multimodal scientific publishing.

1.3. Research Problem and Research Questions

The present work is aimed to solve an equation (digital multimodality + scientific publishing). As illustrated in Figure 1 and introduced in the previous sections, an extended version of this equation would include two regions, four research areas and the four basic phases of the scientific publishing cycle. More precisely, moving from the background to the foreground, Figure 1 shows:

1) The topics that the present study aims to connect, "digital multimodality" and "scientific publishing". These two topics are represented in the form of two partially overlapping triangles or zones. They refer also to the two terms of the equation that this work intends to solve (see 1.3). The first term, 'digital multimodality', emphasises the fact that multimodality is not automatically digital and occurs also in contexts that are unrelated to the online world. In the same time there is a mutual reinforcement between multimodality and digitality as it is clearly stated at the beginning of section 4 of the *SAGE Handbook of digital dissertations and theses*:

> Multimodality is not synonymous with digitization. Multimodality preceded the digital by several centuries, but its revival and re-formulation has been brought about partly by the affordances of the digital (Andrews et al. 2010:241).

The second term of the equation ("scientific publishing") points out that this study focuses on written and formal forms of scientific publishing and do not encompass "broader, much more diverse, often less formal, and certainly more rapidly evolving set of practices that comprise scholarly communication" (Lynch 2003:03). Maintaining this distinction between scientific publishing and scientific communication throughout this work, however, can be a complex matter. Indeed one of the first consequences of a digital and multimodal approach to scientific publishing is to challenge established or common distinctions, such as the one between formal and informal communication, between primary, secondary and tertiary sources of information, as well as between scientific journals, repositories, archives, databases and the like (see 3.3.1).

2) To come back to the description of the Figure 1, the second layer indicates four research fields: composition studies, genre studies, information studies and social semiotics. These four research fields, used as main sources of information in the present study, are represented in the form of four partially overlapping rectangles. Seen in conjunction, they compensate for the fact that bringing together digital multimodality and scientific publishing does not correspond to a fully developed research area yet, as already previously discussed. Finally, in our view, they allow an editor for instance, to address the most important issues raised in relation to multimodal scientific publishing in journal and therefore to solve the equation under scrutiny.

These four research fields can be divided into two zones or regions depending on whether they concern themselves with the 'digital multimodality' term or the 'scientific publishing' term of the equation to solve in the context of this work.

The 'digital multimodality' region is associated with two main research fields:

- Rhetoric and composition studies are useful in researching issues related to the composition and design of a scientific multimedia artefact;
- Social semiotics and specifically multimodal social semiotics help dealing with issues related to the reception of the scientific multimedia artefact and how it makes sense within the scientific community.

The 'scientific publishing' region is covered by another two established research fields:

- Genre studies inspire reflections on the scientific multimedia artefact from a normative viewpoint and help grasping academic standards and their evolution related to the scientific article genre.
- Information studies inform the study by emphasising the systemic context: a multimodal scientific artefact is the result of a production system based on a specific organisation (a scientific journal for instance). Moreover, information studies address the issues of information storage, retrieval and preservation, including the specific challenges related to the preservation of scientific multimedia artefacts.

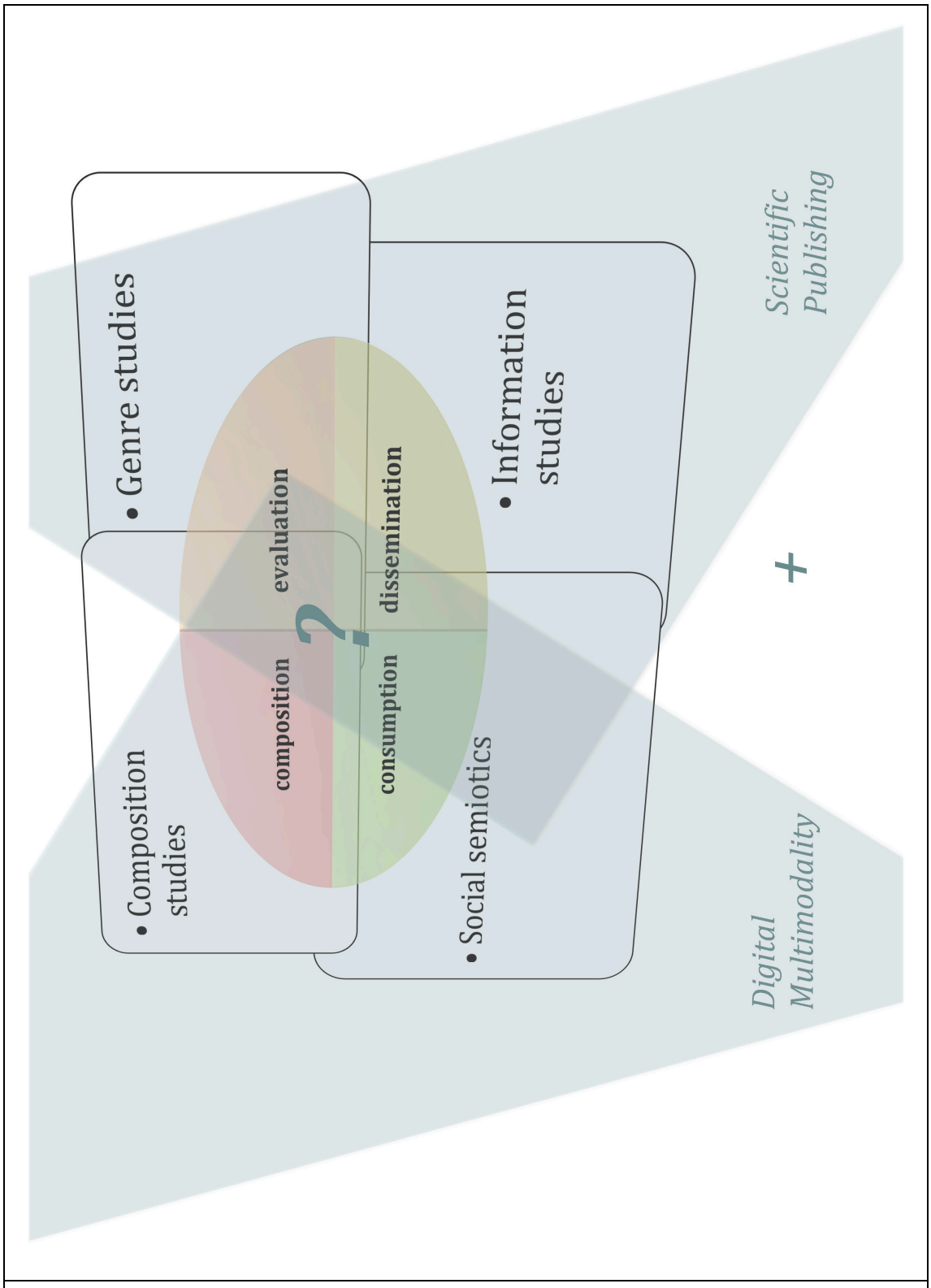


Figure 1: An equation to solve (Expanded version)

3) The four research areas or sources information are further associated – as seen in the third layer in the Figure 1 - with one of the four main phases of the scientific publishing cycle: composition/submission and evaluation, dissemination and consumption. This is shown in the figure by a circle divided into four quadrants. In other words, the four main sources of information used in this work can be approached from the viewpoint of a disciplinary focus. This disciplinary focus contributes to informing a specific phase of the scientific publishing cycle: the phase of submission – that is to say the phase of composition (or design) of a multimedia artefact – is associated with composition studies, the phase of evaluation with genre studies, the phase of dissemination with information studies and the phase of consumption or reception with social semiotics. More precisely

- Composition studies focus on design and production, i.e. on sketching, structuring, drafting, writing, assembling etc. – that is to say on creating - a scientific multimedia artefact by means of a variety of semiotic resources. This multimedia artefact is then submitted to a journal.
- Social semiotics deals with issues related to interpretation and meaning-making. This is the reason why this domain is paired with this phase of consumption or reception.
- Genre studies are associated with the phase of evaluation or revision mainly due to first the normative dimension of a genre and second the relative stability of a genre over time. In this context, the scientific multimedia artefact is appreciated (evaluated, assessed, revised...) in accordance with established conventions and functions and then in relation to its practical impact within the scientific community.
- Finally, information studies are associated with the phase of dissemination and distribution. In that case, the multimedia artefact is part of an information system and approached according to the operations taking place in the scientific communication system, the scientific journal in this work.

Associating each phase of the scientific publishing cycle with an established research field serves obviously as a heuristic for advancing the present piece of research, not as a typology of these fields. To take but one example: the scope of

information studies can evidently not be reduced to the dissemination phase and the dissemination phase is indeed not disconnected from the other phases. Nevertheless, information studies - or information science in the following quote is mostly concerned with information transfer and therefore the dissemination phase:

> Information science is concerned with the generation, collection, organization, interpretation, storage, retrieval, dissemination, transformation and use of information, with particular emphasis on the applications of modern technologies in these areas. As a discipline, it seeks to create and structure a body of scientific, technological, and systems knowledge related to the transfer of information (Griffith as cited in Martínez-Arellano 2013:n.pag.).

In view of the extended version of the equation and all its different components, it is now possible to say that the present study is built upon the following statement from which three research questions are derived. Multimodal scientific publishing is more than multimedia integration, even if multimedia integration is a necessary condition for multimodal publishing. It is a "toolforthought" (Schaffer and Clinton 2006:283), that is to say a mode of thinking enacted through the interplay of various modes of communication and representation and at the same time a means of communication and representation supporting a mode of thought. Multimodal scientific publishing therefore involves a thorough revision of the conventional phases (and associated processes, products and activities) of the scientific publishing cycle from composition/submission and evaluation to dissemination and consumption, in accordance with new digital opportunities and also with new constraints coming along with them. From the perspective of the (scientific) knowledge generation cycle, it also involves by ricochet "the active behavioural phase, the reflective thinking phase, the interpretive sense-making phase and the social validation or evaluative phase" (Edwards 2009:6) of the research process to be transformed or modified.

Consequently, it can be argued that taking advantage of the affordances of the web, multimodal journals, based on a multimodal publishing paradigm (see 4.1

and 5.1), strive to reconnect what was previously disconnected through print technologies: the multiplicity of modes of communication and representation (i.e. multimodality) mainly associated with the empirical phase of the research process on the one side, and the dissemination phase of the research process, that is to say the formal research article made of written words and static visuals (still images, graphs and figures) on the other side. In other words, a multimodal approach to scientific publishing is an opportunity to overcome the inherent limitations of the preferred modes of communication and representation used in conventional, printed or online, scientific journals (written words, still images, graphs and figures) and an opportunity to include a wider range of semiotic resources in a research article.

Nevertheless, the extent to which the potential of a multimodal approach to scientific publishing in terms of knowledge generation and dissemination is embraced and actually realised in current online scientific journals that allow researchers to publish articles based on multimodal formats remains to be analysed and discussed. The next three key research questions are derived from the previous statements and are intended in consequence to explore how editors of a few scientific journals attempt to change the way scientific knowledge is disseminated through an editorial policy committed to encourage multimodal publishing and the use of multiple modes of communication and representation.

- RQ1. Multimedia integration is a necessary condition for multimodal publishing. Which multimodal integration strategies underlie the dissemination of scientific multimedia artefacts in multimodal scientific journals?
- RQ2. Multimodal publishing involves new opportunities, challenges and constraints. If multimedia integration is not a sufficient condition, which specific editorial policy is applied in multimodal scientific journals to enable publishing articles based on multimodal formats and to disseminate scientific multimedia artefacts that meet scientific standards and requirements?
- RQ3. Finally, if a multimodal scientific journal is dedicated to disseminating scientific multimedia artefacts, in what way and to what extent can it be argued that the conventional scientific publishing cycle (from

composing/submitting to evaluating, and from disseminating to consuming), historically linked to the development of print technologies, is changed in multimodal scientific journals?

The next section outlines the methodology used to answer these research questions.

1.4. Methodology

To answer the research questions posed above, an analysis of existing online scientific journals that allow researchers to publish articles based on multimodal formats – that is to publish multimedia artefacts – is carried out in two steps. Each step is conceived as a loop of analysis linked to a specific method. These two interrelated loops of analysis are presented in this section.

At a general level, this work is a digital ethnography (Masten and Plowman 2003:75) of a "territory" – multimodal scientific publishing – that is situated, as chapter two and three will explain in great detail, at the crossroads of four interdisciplinary research fields: composition studies and social semiotics on the one hand and genre studies and information studies on the other hand. At a more specific level, the focus of the current study is on scientific journals, that is to say a small part of the 'multimodal scientific publishing' territory which includes a variety of other scientific publishing environments, such as blogs, repositories, databases, personal websites etc. (see 3.3.1).

As a first step, the empirical analysis conducted in this exploratory study focuses on scientific journals disseminating multimedia content of some sort. After locating scientific journals with multimedia content, a content analysis of the editorial policy of these journals is employed in order to gain familiarity with the most prevalent multimodal integration strategies implemented in scientific journals. On this basis, a descriptive typology of multimodal integration strategies implemented in scientific journals is proposed.

In a second step of the empirical analysis, the resulting descriptive typology is further scrutinised in relation to other important conventional dimensions of a scientific journal, such as the peer-review system, the publishing model and the

archiving policy. The goal is to define the main characteristics of a multimodal scientific journal in comparison to other online scientific journals and to distinguish between multimodal journals and multimedia journals. A method called general morphological analysis (GMA) is used (Ritchey 2011) in order to achieve these goals. GMA "is a method for structuring and investigating the total set of relationships contained in multi-dimensional, non-quantifiable, problem complexes" (Ritchey 2011:8). The problem complex under discussion in this work is summarised as an equation (digital multimodality + scientific publishing). It is a multi-dimensional and a non-quantifiable problem because, as previously mentioned, multimodal scientific publishing is more than multimedia integration and involves concomitant changes in relation to composing a scientific article, to established scientific genres, and to scientific requirements and standards (see Chapters 2 and 3).

After defining the main dimensions of a scientific journal and how these dimensions are conceived in four scientific journals, the GMA method is used in order to show that a multimodal journal is based on a multimodal publishing paradigm. This multimodal publishing paradigm (the total set of relationships contained in a problem complex, to borrow Ritchey's words) is particularly highlighted in a multimodal scientific journal by analysing the relationships between four dimensions: a) the multimodal integration strategy and b) the scientific purpose associated with this strategy, c) the peer-review system and d) the collaborative publishing method associated with this peer-review system. In other words, a multimodal publishing paradigm is a multimodal understanding of knowledge generation and dissemination that permeates the different dimensions of a scientific journal, and especially the multimodal integration strategy, the peer-review system, the collaborative publishing and the scientific purpose. In line with this reasoning, it is also argued that a scientific journal delivering some multimedia content to readers/users is not automatically based on a multimodal publishing paradigm.

The results of the empirical analysis conducted in this work in two steps are detailed in chapter four. They are understood as some empirical solutions, already implemented in existing online scientific journals, of the equation placed

at the core of this work (digital multimodality + scientific publishing). In the two next chapters (two and three), the present work is discussed in relation to the above-mentioned four research fields that contribute to delimitate and specify which are the main issues raised by a multimodal approach to scientific publishing (multimodal scientific publishing). Chapter two deepens the exploration of the 'digital multimodality' term of the equation to solve, supported by insights from social semiotics and composition studies. Chapter three, in contrast, treats the 'scientific publishing' term of the equation to solve with help from genre studies and information studies.

2. The 'Digital Multimodality' Term of the Equation

The 'digital multimodality' term of the equation is introduced in two steps: first, in relation to the notion of design as understood in the field of composition studies and other complementary research areas. Composing a scientific article for publication in a journal is no longer writing a paper but designing a multimedia artefact (2.1). The 'digital multimodality' term is then approached in relation to social semiotics and four interrelated notions: semiotic resource, media, mode and mood (2.2). Composing a scientific article for publication in a journal is assembling various semiotics resources together in order to communicate specific meanings to specific audiences. Whereas the second section questions the nature of the connection between semiotic resources within a multimedia artefact (three instances are distinguished, the intra-, the inter- and the trans-modal instances), the third section addresses the issue of the multiple "processes of change to representations" (Bezemer and Kress 2008:169) – that is the process of resemiotization. It concludes that assembling different semiotic resources together, in order to design a scientific multimedia artefact, is about translating various semiotic resources from one into the other as the research process unfold from the field to the lab and from the lab to the screen.

2.1. Designing a Multimedia Artefact

Composition studies, the first main source of information used in this work, is introduced in the first part of this section dealing with the process of shaping a multimedia artefact through various steps of creation and composition before its production is finished and before it is disseminated. Media studies, visual communication and [augmented reality] are discussed in a second part. Approached in this work as complementary perspectives to composition studies, these research areas also allow us to understand better the process of designing a multimedia artefact and its challenges.

2.1.1. The Notion of Design

In a practice-oriented way, the field of composition studies investigates mostly teaching environments and classrooms (see for instance Ferdig and Pytash 2013). The focus is on "how does it work" (see Davis 2011:n.pag., about "writing with sound") more than on “what does it mean” to "compose on the screen" (Parker Beard 2012:61). In composition studies expertise in web-writing and multimodal composing has been accumulated. Composition studies are therefore well suited to understand from within the challenges encountered in the process of designing, for instance, an essay that makes use of a digital, multimodal format to present an argument, i.e. an essay meant to be read on the screen (it makes use of various semiotic resources) and online (it makes use of hyperlink information). For an example for such a "multimodal essay", see Figure 2, *Stories From Dance!* (BE Essay n.d.).

With the exception of Ball (2012), the specific challenges of multimodal composition of essays created for the purpose of scientific publishing (e.g. in a journal) seem not yet to be further explored:

> We have been slow to explore the potential of interactive, immersive, and multimedia expression for our own thinking and scholarship, even as we dabble with such forms in our teaching. With a few exceptions, we remain content to comment about technology and media, rather than to participate more actively in constructing knowledge in and through our objects of study (McPherson 2009:120).

Guaraná (2010), in the description of a project dedicated to digital preservation, points out some of the challenges involved in multimedia scholarship, and emphasises that…

> … we are still learning how to properly integrate moving images without text or content redundancy or unnecessary use of different media. To the content, multimedia features add a form that must be carefully constructed, especially if the ultimate product is non-linear (Guaraná 2010:7).

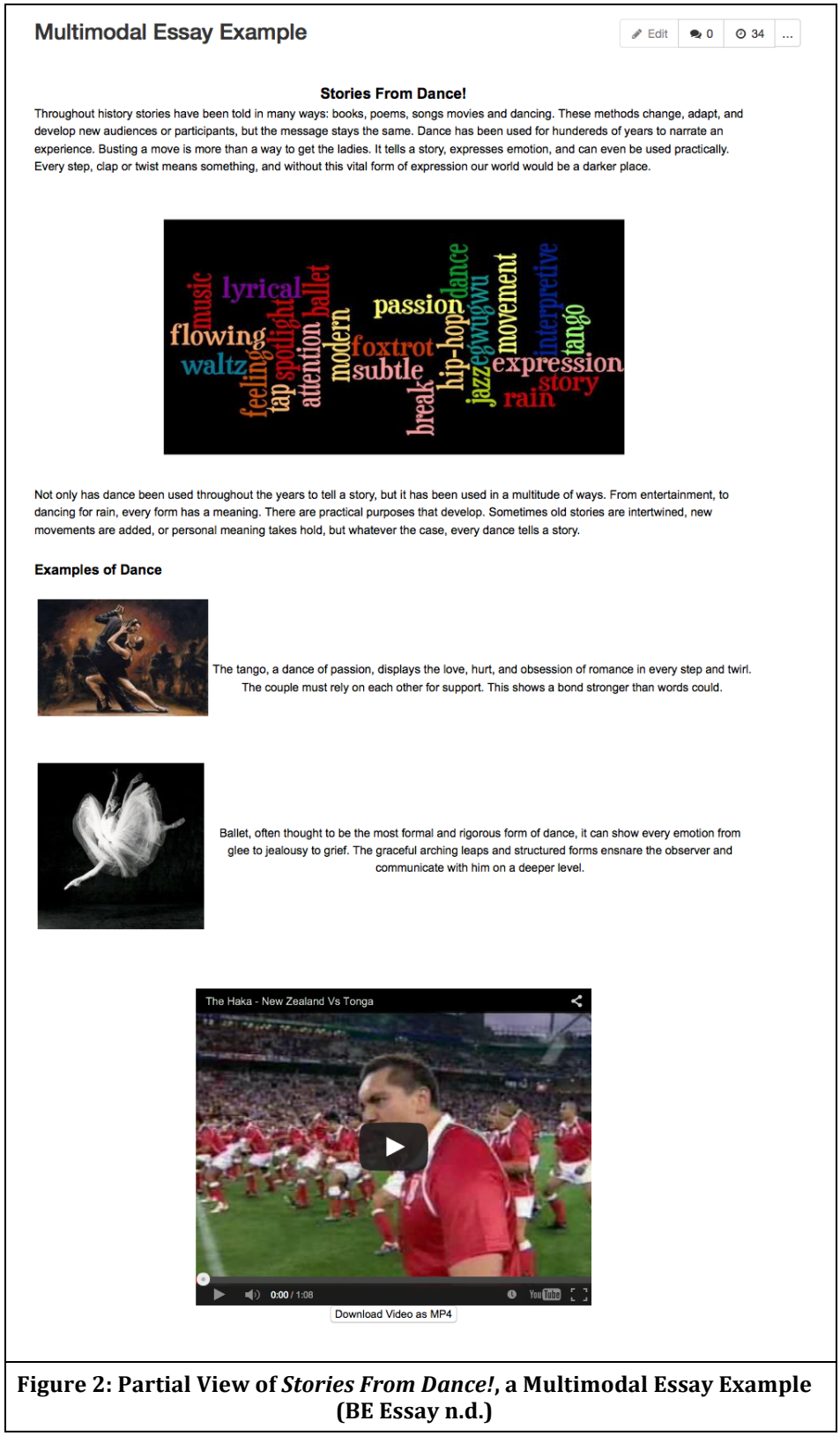


Figure 2: Partial View of *Stories From Dance!*, a Multimodal Essay Example (BE Essay n.d.)

Composition studies help in understanding multimodal composing from the point of view of a producer who experiments with the design of a multimedia

artefact. From this perspective, the field of composition studies is different from the field of social semiotics that provides analyses focusing on de-constructing already designed multimedia artefacts. In other words, in the field of composition studies, "design moves us from rhetorical criticism to invention and production" (Hocks 2003:644). Barish and Daley (2005) describe the same situation in relation to educational needs and insist on practising in order to understand how semiotic resources work:

> Yet, because form and content are inexorably connected in multimedia (in a way not necessarily true of print) one must first and foremost understand what different forms of media do and do not do. Otherwise, media elements tend to become merely decorative or illustrative, as opposed to integral to the argument being advanced or the text being explicated. However, although we have all been taught to construct and deconstruct text since elementary school, none of us has been taught the principles of media on such a level. It is not surprising then that few attempts at multimedia creation exceed the standard PowerPoint presentation that merely uses the screen to display text and illustrations (Barish and Daley 2005:40).

Besides writing and its variations linked to digitality (web writing and digital writing), the notion of text and textuality are critical in the field of composition studies. Those notions are, however, ambiguous due to their association with words. In this study, the notion of design (New London Group 1996) or multimodal design (Kress and Selander 2012) is therefore preferred instead of writing. For the same reason, *multimedia artefact* is used instead of *webtext* in order to describe the scientific article published in a multimodal journal.

A webtext is a text that can only be read online and that cannot be printed out (Ball 2012, 2013). However, since *webtext* still contains *text* and since a webtext can also be confused and reduced to hypertext (Bowie 2001) a choice was made to reserve the term *webtext* for designating a specific multimodal format linked to the journal *Kairos* (the promoter of the notion) (see 4.3.2). In sum, a multimedia artefact is an all-embracing category including all kinds of digital objects – webtexts, and hypertexts as previously noted, as well as other multimodal documents (Bateman, 2008) - based on formats that support the use

of semiotic resources "that exceeds the alphabetic" (Selfe and Takayoshi 2007:1). The difference between a multimedia artefact and a scientific multimedia artefact relies on the fact that the latter would be designed for a scientific purpose and would be published especially in a scientific journal. In consequence, a scientific multimedia artefact is also a scientific article that has to be evaluated in relation to the scientific article genre that has been codified and consolidated across the past centuries (Gross et al. 2002). The question of the genre and of the scientific article genre is discussed in the next chapter (see 3.1.1).

In the next subsection, the notion of design is further developed in relation to insights from media studies, visual communication studies, communication design and other fields of study dealing with practical issues related to augmented reality.

2.1.2. Related Notions in Various Research Areas

Practices of designing a multimedia artefact diverge substantially from practices of composing texts due to a different set of digital possibilities and constraints, as highlighted particularly by the field of media studies. Beside the notion of design, multimodal composing in this case is often associated with notions, such as sampling (Manovich 2002), remixing (Manovich 2002; O'Neil 2006), mashing up (O'Neil 2008; Booth 2012). These notions refer to composition processes that are more familiar to artists and designers that are considering stretches of sound, video and words as their raw material than to scientists interested in empirical data, information that can be referenced and knowledge that is reliable and reproducible. However, the "remix culture" (Diakopoulos 2005:n.pag.) is getting stronger and the cultural atmosphere that it spreads contributes to address the question of authorship in the digital age. Adami lists some of the "semiotic practices" that transform the traditional conception of an author as a creator by comparing them to the "old" ones: selection and re-use (which cannot be equal to mere copy-and-paste) versus brand new creation, editing (adjusting) versus cohesion, recontextualisation versus on purpose, dialogue versus monologue, modularity versus linearity,

hyper-intertextuality versus completeness, inferences versus explicitness (Adami 2011b:slide 18).

Consequently, composing as remixing – "any reworking of already existing cultural works, whether visual projects, software, or literary texts" (Manovich 2007a:6) - results not only in a change of the content and of the form of the artefact produced online but also in a transformation of the narratives used to support an argument, whether in literature or in sciences (for the notion of scientific narrative, see Sheehan and Rode 1999). From this perspective, it becomes clear that multimodal composing is more than digitizing a text, i.e. converting known writing practices related to paper into online practices on the one side and more than producing an enhanced version of written text by integration of multimedia content on the other side:

> Comment cette écriture numérique modifie-t-elle des procédures de narration dans la fiction, ou bien de preuve dans les textes de savoir? On est devant une écriture numérique qui déborde la numérisation des textes déjà là et qui se lirait avec des nouvelles formes de communication écrite, par exemple, le courrier électronique, les SMS, les blogs (Chartier 2013:n.pag.).

Research areas dealing with information visualisation and scientific visualisation are briefly introduced here. These are research areas and applied fields that share the concern with composition studies to create and process visual artefacts for different purposes. The emphasis is placed a) on producing a (visual) object, b) on communicating and delivering a message to a target audience, and finally c) on providing visual analytical tools. For instance, visual communication…

> … means all the ways that writers and readers interact through the look of pages and screens. Visual design means the structured process of planning for this interaction. There are other similar, overlapping terms. The widely used term document design covers much the of same ground as visual communication, except that document design may also refer to matters of language, such as employing certain types of paragraph and sentence structure that have been shown to be easily understood by readers (Hilligooss and Howard 2002:1-2).

The tension between functionality and aesthetics with regards to a message or information contained in a document or an artefact is under close scrutiny in such fields as information graphics (or infographics) or graphic design:

> Published documents have long incorporated the specialized knowledge of graphic design. Graphic design encompasses the entire process of delivery, or to use a publishing term, production: arranging text and visuals on pages or screens, plus choosing type, color, and details of paper, ink, and binding (for print documents) or platform and interface (for screen documents). Even publications that seem to be entirely textual have been visually designed (Hilligoos and Howard 2002:164).

In relation to science and scientific publishing specifically, the field of information graphics is often associated with popularization – communicating research findings to a broader public - and to Edward Tufte and his work on the beautiful evidence (Tufte 2006). According to Tufte, "graphics reveal data" (Tufte 2001:13). According to Hilligoos and Howard, information graphics…

> … is concerned with the clear, accurate production and interpretation of scientific, technical, and numerical research data. Until the introduction of personal computers, information graphics were typically the domain of specialized technical illustrators. Illustrators made a variety of charts, figures, and other illustrations for scientific and engineering journals, but also popular magazines and newspapers. When computers (and calculators) put graphing tools into the hands of researchers themselves, interest in the design of information graphics moved out of the illustrator's craft and into wider discussion (Hilligoos and Howard 2002:167).

Visualisation, in contrast to the field of composition studies that deals with documents and genres, is intimately related to quantitative data. To briefly summarise, data can be defined as a raw material that is "recorded, … captured and stored" (Liew 2007:n.pag.) and that needs to be processed in order to communicate information in an appropriate, expressive and effective manner (Aigner et al. 2011). Visualisation in this context is an operation based on a set of techniques consisting of converting and transforming data into information,

which can in turn be analysed, interpreted and reused as knowledge in different situations of life. In our view, this process of transforming data into visual information can also be understood as a process of designing a multimedia artefact.

As an interdiscipline, communication design is of particular interest for an approach to composition that no longer relies on textualisation and visualisation alone, but that taps into the full potential of other semiotic resources, as emphasised for instance in a Wikipedia entry:

> The term communication design is often used interchangeably with visual communication, but has an alternative broader meaning that includes auditory, vocal, touch and smell. Examples of communication design include information architecture, editing, typography, illustration, web design, animation, advertising, ambient media, visual identity design, performing arts, copywriting and professional writing skills applied in the creative industries (WP Design n.d.).

In this context, auralization (Vorländer 2011) as well as tactilization (Landner 2004), can be understood as analogues of visualisation:

> Visualization … refers to generating graphical images that capture essential characteristics of the data and highlight interesting relationships. Another approach, which has received far less attention, is to use sound as a means of presenting complex information. This approach, called auralization, is the auditory analog of visualization (Volpe 2002:n.pag.).

Finally, the broad field of augmented reality (AR) and its numerous applications in biology, chemistry, astronomy as well as the medical, commercial and the military fields (Azuma 1997; Lee 2012) can be interpreted as a concrete extension of the logic described above in introducing auralization and tactilization. The Steven Ley Research group defines augmented reality in connection with other fields of research:

> Augmented Reality (AR) is a new technology as well as a field of research sitting at the interface of Virtual Reality (VR), Artificial Intelligence (AI) and Computer

> Graphics (CG). In AR applications, artificial data are overlaid on to the real world environment, therefore endowing it with additional information in a new interactive manner (SLRG n.d.).

In our view virtual reality as well as augmented reality are multimodality being pushed to its limit. They both rely on an approach to reality that exceeds composing as designing (composition studies) on the one hand and composing as visually communicating information (infographics) on the other hand. In consequence, it can be argued that multimedia artefacts are "3D virtual objects [that] are integrated into 3D real environment in real time" (Azuma 1997:355). In this context, people "are expected to experience a computer-generated virtual environment" (Lee 2012:13) in the case of virtual reality or a "real environment [that is] extended with information and imagery from the system" in the case of augmented reality (Lee 2012:13) In the case of augmented reality applied to books, for instance, the designed multimedia artefact …

> … is called the Magic-Book" … makes people's fantasies about becoming a part of the story a reality by using both a normal book and a handheld see-through AR device. People can turn the pages of a book, look at pictures, and read the text without any interactive assistance (Lee 2012:16).

As a further expansion of the notion of publishing, augmented books therefore

> can be developed into an AR edition after publication by installing special software, called AR tool kits, on users' computers and pointing an embedded camera of their PCs at the book to view computer-generated 3D models appeared out of the book (Lee 2012:17).

With regards to sciences, Lee, in his literature review of augmented reality and "how it applies to education and training, and the potential on the future of education" (Lee 2012:13), describes different domains, such as "augmented astronomy", "augmented chemistry" and "augmented biology". Other "employment of AR" is mentioned in museums for the display of collections to visitors.

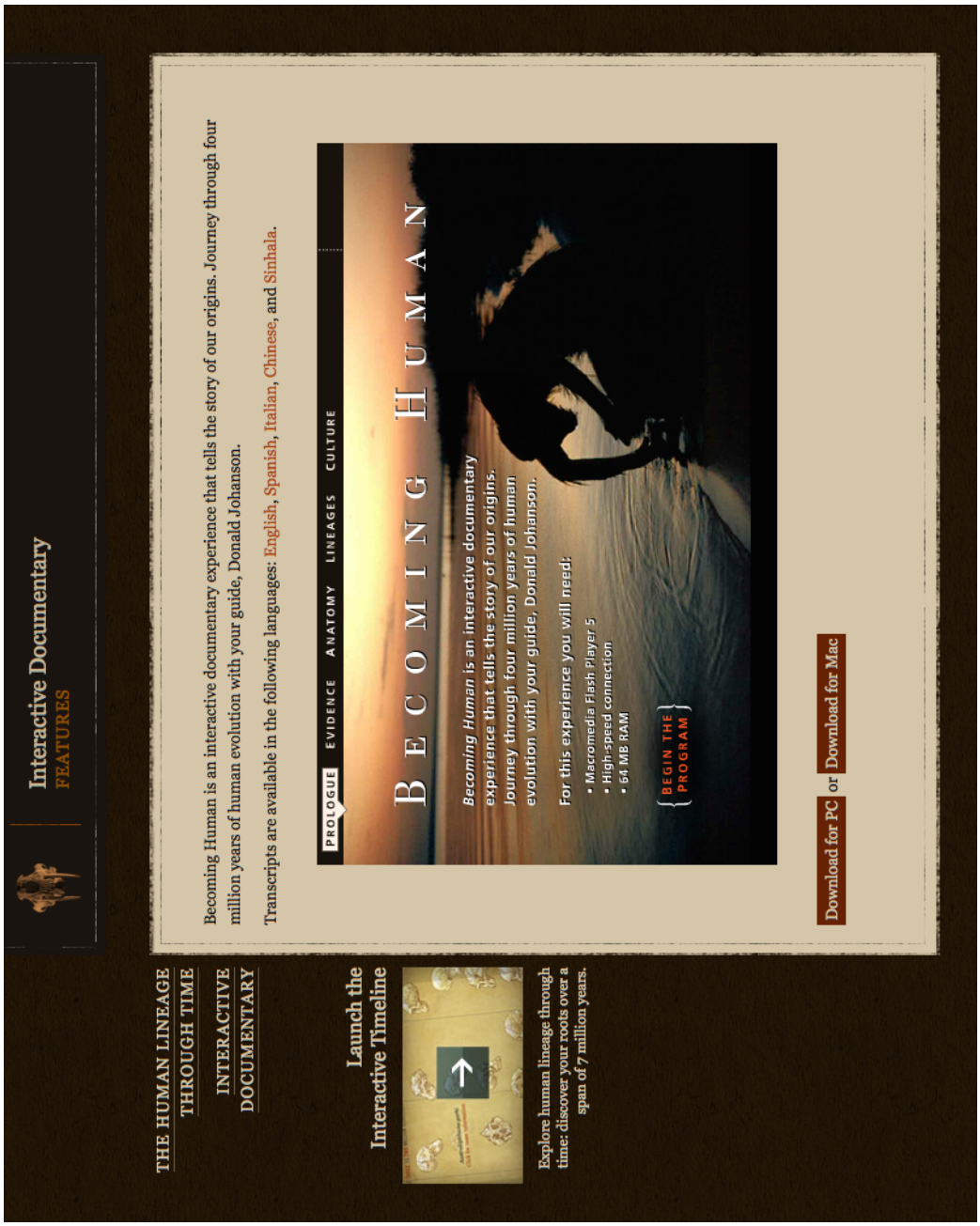


Figure 3: *Becoming Human*, an Example of an Interactive Documentary Experience (IHO 2008)

In sum, augmented reality helps to envision a scientific multimedia artefact that is a virtual simulation of 3D models, objects or environments on the one hand, or a dynamic and interactive enhanced 3D illustration or web-documentaries on the other. In that respect, already existing web-documentaries provide "interactive documentary experiences" (JFK Presidential Library and Museum and The

Martin Agency 2012) inviting the user to experience a multimedia artefact as a project rather than an object (see Figure 3).

To conclude, affective computing viewed in relation to augmented reality, can be considered as an attempt to understand how individuals – who are no longer readers or users – are engaged in a multisensory experience while dealing with multimedia artefacts. Emotions are thus a last aspect to be considered in dealing with designing a multimedia artefact:

> The Affective interaction has contributed to an understanding of the socio-cultural aspects of emotions … The Technology as Experience-field has shifted our focus from emotion as an isolated phenomenon towards seeing emotion processes as one of the (important) aspects to consider when designing tools for people … Emotions [are] constructed in interaction – between people and between people and machines (Höök 2012:n.pag.).

All of those elements (augmented reality, sensory integration, emotions) linked to multimodality contribute to "understanding aesthetic practices and experiences" (Höök 2012:n.pag.) underlying the reception of a (scientific) multimedia artefact and eventually how people assign meaning to their experiences. The next section focuses on meaning-making processes and the reception of a multimedia artefact from the viewpoint of social semiotics. In other words, after a first section dedicated to understanding how a (scientific) multimedia artefact is composed, the following section is an attempt to explain how a (scientific) multimedia artefact is consumed and interpreted.

2.2. Assembling Semiotic Resources Together

After the field of composition studies, the field of social semiotics is the second of the four main sources of information to be connected in order to solve the equation placed at the core of this work (digital multimodality + scientific publishing). The field of social semiotics contribute, as it is the case for the field of composition studies, to inform the 'digital multimodality' term of this equation. The following section examines how this is done. In a first subsection, four notions are discussed (semiotic resource, medium, mode and mood) in

order to define a multimedia artefact as a toolforthought (Schaffer and Clinton 2006:283) (2.2.1). In a second subsection, the multimedia artefact, understood as a toolforthought, is further analysed in terms of three instances of multimodality named, respectively, intra-, inter- and trans-modality (2.2.2). These three instances, in final analysis, describe three different methods for assembling semiotic resources together in a multimedia artefact - that is to say three multimodal integration strategies.

2.2.1. The Notion of Semiotic Resource

The focus placed in the field of social semiotics on the variety of semiotic resources used by humans to communicate meaning and particularly to represent and generate (scientific) knowledge is essential within the context of our research endeavour. In brief, social semiotics provides theoretical frameworks that help us to understand, first, what meaning-making means when speech and writing are no longer considered as the main modes used for communicating a message. Second, social semiotics helps us to explain why the full range of semiotic resources used in a suitably designed multimedia artefact, does not necessarily need to be systematically translated into words in the text body of a research article. Finally, it allows us to revise, by ricochet, what reading and writing mean, "from the perspective of the designer-as-producer, or from the designer-as-user point of view (Kress and Selander 2012:166). At this point, social semiotics and composition studies meet each other around the notions of design understood as "the choice and combination of semiotic resources" (Mavers 2007:156).

Semiotic resources are closely associated with modes on the one hand and with media on the other hand. Semiotic resources are…

> … actions and artefacts we use in order to communicate, whether they are produced physiologically – with our vocal apparatus; with the muscles we use to create facial expressions and gestures, etc. – or by means of technologies – with pen, ink and paper; with computer hardware and software; with fabrics, scissors and sewing machines, etc. (van Leeuwen 2005:3).

Semiotic resources are associated with a certain materiality. This is, for instance, the "medial aspect of language" or the "phonic vs. graphic realisation of discourses" (Koch and Oesterreicher 2001:585). In comparison, modes are not visible, palpable or audible. They refer, for instance, to the "conceptional aspect of language", the "spoken=informal vs. written=formal character" (Koch and Oesterreicher 2001:585). Modes "cannot be directly observed … they are rule-governed, codified sets of meaning-resources" (Dicks et al. 2006:82). In short, a mode is how a semiotic resource is conceptionally enacted or expressed in a discourse, a place, an event or an object whereas a semiotic resource is a mode that is medially embodied, captured or encapsulated in an discourse, an object, a place or an event. A facial expression for instance is a mode (this is an expression that needs to be interpreted); the face in itself is the semiotic resource used to convey this peculiar facial expression. The connection between modes and media can be deduced from the above explanation: "Media are the specific material forms in which modes are realized, including tools and materials (Dicks et al. 2006:82) or "Materially, medium is the substance in and through which meaning is instantiated-realized and through which meaning becomes available to others (Bezemer and Kress 2008:172).

In order to distinguish between semiotic resources and media, in the remainder of this work, a semiotic resource is defined as a material resource, such as written words, still and moving images, sounds etc., used in the process of designing a scientific multimedia artefact whereas a medium is defined as a publishing environment used to produce and disseminate a (scientific) multimedia artefact, such as a website, a database or a blog. In line with Manovich, a publishing environment is more precisely a "metamedium" (Manovich 2007:7) – that is to say a medium made of a collection of various types of semiotic artefacts interacting with each other; semiotic artefacts that can serve in turn as media through which other semiotic artefacts can be combined to communicate meaning:

> We may think of this new metamedium as a vast library of all previously known media techniques. But that is not all. Once all types of media met within the same digital environment—and this was accomplished in the second part of the

> 1990s—they started interacting in ways that could never have been predicted or even imagined previously (Manovich 2007:7).

From this perspective, as a metamedium, a scientific journal is a publishing environment that can be employed as a channel for disseminating scientific information based on multimodal formats, and/or as a platform for archiving scientific multimedia artefacts, and/or as a tool for designing a multimedia artefact in accordance with scientific standards, and/or as a multimedia artefact itself.

Along with the notions of mode, medium and semiotic resource, the notion of mood as defined in the field of social semiotics, is another notion that helps us to understand what makes a multimedia artefact, precisely, a *scientific* multimedia artefact. In comparison to a mode or a medium, a mood is associated here with the scientific atmosphere or touch created in the process of designing a multimedia artefact. A mood is a planned or anticipated relationship between a text or a multimedia artefact and its audience or readership. On the 'designer' side, "creating a mood" means "communicating to readers a set of signals indicative of the scientific status of a production. On the 'user' side, the expression of a mood is a kind of immediate or intuitive understanding that a paper, for instance, is a *scientific* paper.

As another relatively independent factor that contributes also to the process of meaning making, it is possible to induce a mood by generating a specific narrative, for instance via a computer, and by mimicking a visual and a spatial organisation as well as a rhetorical and a linguistic structure, closely linked to a "genre identity" (Bateman and Delin 2001:n.pag.). SCIgen (see Figure 4) is an example of "an automatic CS paper generator … a program that generates random Computer Science research papers, including graphs, figures, and citations" (SCIGEN n.d.). In the worst case, this possibility to "simulate" a mood can result in various forms of misconduct, such as disseminating fake science or launching fake journals on the Internet (see three blog posts relating to this topic: Beall 2012, 2014; Knox 2013).

Deployment of Forward-Error Correction

PhB

Abstract

Unified wearable theory have led to many unfortunate advances, including local-area networks [6] and scatter/gather I/O [6]. Given the current status of virtual epistemologies, hackers worldwide obviously desire the investigation of von Neumann machines. *RowedLuxe*, our new heuristic for the synthesis of massive multiplayer online role-playing games, is the solution to all of these obstacles.

Table of Contents

1 Introduction

Recent advances in extensible methodologies and optimal methodologies are based entirely on the assumption that architecture and RAID are not in conflict with IPv6. Continuing with this rationale, despite the fact that conventional wisdom states that this issue is never answered by the refinement of IPv4, we believe that a different method is necessary. The flaw of this type of method, however, is that wide-area networks can be made relational, constant-time, and efficient. The exploration of journaling file systems would profoundly amplify "smart" theory.

In this paper we describe a concurrent tool for analyzing reinforcement learning (*RowedLuxe*), which we use to argue that vacuum tubes and rasterization are usually incompatible. Our aim here is to set the record straight. The flaw of this type of approach, however, is that the acclaimed unstable algorithm for the deployment of RPCs by Williams et al. is Turing complete. Continuing with this rationale, although conventional wisdom states that this grand challenge is entirely answered by the construction of symmetric encryption, we believe that a different method is necessary [8]. Certainly, the usual methods for the improvement of systems do not apply in this area.

We question the need for erasure coding [31]. Similarly, we view hardware and architecture as following a cycle of four phases: observation, prevention, study, and location. We view interposable cyberinformatics as following a cycle of four phases: storage, storage, exploration, and deployment. Even though conventional wisdom states that this quandary is rarely surmounted by the analysis of superblocks, we believe that a different method is necessary. Thus, we use linear-time configurations to argue that forward-error correction and multicast solutions are generally incompatible.

The contributions of this work are as follows. We validate that although superblocks can be made permutable, stochastic, and autonomous, online algorithms and evolutionary programming can connect to overcome this issue [8]. We examine how randomized algorithms can be applied to the synthesis of link-level acknowledgements.

The rest of this paper is organized as follows. To begin with, we motivate the need for consistent hashing. We place our work in context with the existing work in this area. Finally, we conclude.

2 Model

Motivated by the need for concurrent algorithms, we now present an architecture for arguing that SCSI disks and flip-flop gates [19] are rarely incompatible. Next, we carried out a trace, over the course of several days, validating that our model is feasible. This may or may not actually hold in reality. The question is, will *RowedLuxe* satisfy all of these assumptions? It is.

Figure 1: The relationship between *RowedLuxe* and flexible communication.

Suppose that there exists the construction of object-oriented languages such that we can easily visualize introspective methodologies. *RowedLuxe* does not require such a typical location to run correctly, but it doesn't hurt. Further, our framework does not require such a typical emulation to run correctly, but it doesn't hurt. Although mathematicians mostly believe the exact opposite, *RowedLuxe* depends on this property for correct behavior. See our related technical report [2] for details.

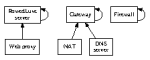


Figure 2: *RowedLuxe*'s large-scale prevention.

RowedLuxe relies on the theoretical architecture outlined in the recent infamous work by Thomas and Zheng in the field of e-voting technology. Rather than locating scalable archetypes, *RowedLuxe* chooses to explore trainable information. Similarly, rather than locating wide-area networks, our application chooses to allow reliable modalities. This seems to hold in most cases. As a result, the methodology that our application uses is not feasible.

3 Implementation

Though many skeptics said it couldn't be done (most notably Niklaus Wirth), we present a fully-working version of our algorithm. Next, since our methodology is NP-complete, hacking the server daemon was relatively straightforward. Next, we have not yet implemented the server daemon, as this is the least technical component of our heuristic. It was necessary to cap the popularity of hash tables used by *RowedLuxe* to 87 dB [8]. Despite the fact that we have not yet optimized for complexity, this should be simple once we finish coding the virtual machine monitor. Our mission here is to set the record straight.

4 Evaluation

We now discuss our evaluation. Our overall evaluation seeks to prove three hypotheses: (1) that the Motorola bag telephone of yesteryear actually exhibits better power than today's hardware; (2) that fiber-optic cables have actually shown weakened expected clock speed over time; and finally (3) that block size is not as important as 10th-percentile signal-to-noise ratio when minimizing bandwidth. The reason for this is that studies have shown that throughput is roughly 20% higher than we might expect [19]. Furthermore, the reason for this is that studies have shown that seek time is roughly 26% higher than we might expect [11]. Unlike other authors, we have intentionally neglected to study hit ratio. Such a hypothesis is rarely a practical intent but is buffetted by previous work in the field. Our performance analysis holds suprising results for patient reader.

4.1 Hardware and Software Configuration

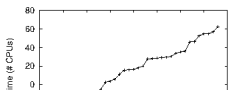


Figure 4: Inducing a Mood. A Partial View of a Fake Scientific Paper Generated With *SCIgen* (SCIGEN n.d.)

Finally, the notion of mood is also of importance as regards scientific communication because the formal scientific seriousness and rigor achieved by the means of the so-called neutrality of a page of written words is put into questions by a new aesthetic linked to the interplay of the multiple modes of representation. This aspect is indirectly tackled when Tufte analyses the "cognitive style of PowerPoint" (2006b:3) in relation to oral presentations. He bluntly concludes: "PowerPoint is evil. Power corrupts. PowerPoint corrupts absolutely" (Tufte 2003:n.pag.). If it is possible to denounce the consequences of

something that is coming close to a "hegemonic visualism" (Tietje and Cresap 2005:n.pag.), or that would be called correspondingly a "hegemonic multimodalism", multimodal scientific publishing is, on the contrary, an attempt to question (social semiotics) the usual orchestrations of semiotic resources in traditional scientific articles and to explore (composition studies) other possible orchestrations in scientific multimedia artefacts. The conclusion is no different with respect to scientific presentations (see Bucher and Niemann 2012:285).

On the basis of the four notions introduced in this section, it can be argued that a multimedia artefact stands at the intersection between modes and moods on the one side and semiotic resources and media on the other side. A multimedia artefact is an object because it is made up of semiotic resources that are assembled together and a medium used to carry information. At the same time, a multimedia artefact is a project: it is intended to communicate meanings to a specific audience through different modes. In sum a multimedia artefact is a toolforthought:

> There are no tools without thinking, and there is no thinking without tools. There are only toolforthoughts, which represent the reciprocal relation between tools and thoughts - between persons and objects, whether natural or constructed - that exists in both ... we connect the nouns tool and thought to suggest that toolforthoughts are the outcome of a process of tools existing in a reciprocal relation with thoughts ... A toolforthought can be analyzed as a tool or a thought, but a toolforthought is always more than the sum of “what a tool is” added to “what a thought is.” It is the reflexive co-construction of both concepts (Schaffer and Clinton 2006:291).

In the following section, three instances of multimodalities are discussed: the 'intra-modal', 'inter-modal' and 'trans-modal' instances. These three instances are three possible interpretations of what it means to assemble semiotic resources together, beyond illustrative purposes, in a multimedia artefact understood, for this reason, as a toolforthought (Schaffer and Clinton 2006:291).

2.2.2. The Intra-, Inter- and Trans-modal Instances of Multimodality

In line with the discussion on how the fields of composition studies and other associated fields (2.1) and social semiotics (2.2.1) contribute to understand the process of designing a multimedia artefact, the nature of the combination between semiotic resources included in a multimedia artefact is investigated in this subsection. The different meanings of the prefix –multi, in the term *multimodality*, allow ultimately for defining three different instances of multimodality (the intra-, inter-, and trans-modal instances). These instances can be used whether to interpret a multimedia artefact already disseminated online or to design a multimedia artefact.

A multimodal social semiotic approach to communication (Kress 2009) calls into question the centrality of language – first its roles and functions – and ultimately its status within different social domains or institutions. This revision and rereading are accomplished by substituting a hierarchy of values associated with modes for a heterarchy based on affordances and metafunctions (for the distinction between hierarchy and heterarchy, see von Goldammer et al. 2003).

An affordance or a modal affordance can be considered as the signature style of a mode communication. It is "what it is possible to express and represent easily with a mode" (Jewitt 2009:24) and the semiotic resources associated to this mode. For instance, "photographs allow us to see modes that are visual: colour, shape, size, position, light. What they do not show us are modes that operate through the other senses – of touch, smell, hearing and taste – such as bodily movement, texture, three-dimensional shape, sounds (Dicks et al. 2006:88). As for speech for instance, "the logic of sequence in time is unavoidable for speech: one sound is uttered after another, one word after another, one syntactic and textual element after another … This sequence in time shapes what can be done with (speech) sounds" (Jewitt 2009:25).

A modal affordance can be further analysed in relation to three metafunctions or "three types of meaning-making that are inherent in all instances of communication" (Unsworth 2006:57). These metafunctions allow an

interpretation of an event, an object, a place, etc. through its representational features (i.e. its "material reality"), its interactive features (i.e. its "social reality") and its compositional features (i.e. to its "semiotic reality") (Unsworth 2006:58). In consequence, various "grammars" can be built, for instance for architecture, sculpture and other displayed arts (O'Toole 1995) or for speech, music and sound (van Leeuwen 1999).

However, in doing so, social semiotics and other areas addressing semiotic issues, indirectly, encourage the development of an apparently infinite variety of complementary notions related to multimodality. These notions are aimed at defining the relationships between modes. In general the relationships are identified by a prefix, such as *inter*, *trans*, *hyper*, *meta*, etc. Besides multisemiotic(s) (O'Halloran 1999; Ventola and Guijjaro 2009), multisemioticity (Leppänen et al. 2013), multisemiosis (Jones 2008) and multimediality (Cicconi 1993, Baldry 2000, Ventola 2005, Brillenburg Wurth 2006 etc.) - it is possible to list the variations expressed:

- In terms of the prefix "inter": intermodality (Bonde 2008, Dreyfus et al. 2012), intermediality (Elleström 2010; Mochocka 2009), intersemiosis (O'Halloran et al. 2009; Jones 2008; Unsworth 2007) and inter-semiotic (Liu and O'Halloran 2009; Stegh Camati 2010);
- In terms of the prefix "hyper": hypermodality (Lemke 2002), hypermodal (Dicks et al. 2006; Zhang and O'Halloran 2012) and hypermedia (Lewis et al. 1995, Treloar 1998, Djonov 2007; Toppano and Roberto 2009, Brusilovsky 2001);
- In term of the prefix "trans": transmodality (Dena 2009), "transmedia" (Lemke 2009; Scolari 2009) and transmedial (Renaux 2010);
- But also in term of "mono" – monomodality (in Forceville 2007, Forceville and Urios-Aparisi 2009); "uni" – unimodal (Lemke 2009); metamodal (Burn 2013); "allo" and "auto" – allomedial and automedial (Varga 2009); "meta" – metasemiotic (Specker 2005); and finally "cross" – cross modal (Ferris and Sarter 2008).

This apparently infinite variety performs one of the "central assumptions of multimodal approaches to representation and communication" (Kress 2005:5)-

that is all discourse, event, text etc. is "always already multimodal" (Lemke 2009:286). While performing this central assumption, it becomes at the same time, almost impossible to state in relation to the issue addressed in this study that, unfortunately, in the vast majority of cases a scientific article published by online journals across disciplines remains monomodal or - better – based on an intra-modal integration strategy (cf. infra). In other words, the written mode is predominantly used to communicate meaning even if other static visuals are also included.

If it remains necessary to promote and emphasise the diversity of modes of communication and representation, exaggerating this logic to the point of absurdity leads to question the relevance of any multimodal approach: if everything is always already multimodal, then what is the added value of the concept of multimodality as an explanatory analytical tool? To overcome this situation, the present study distinguishes between three instances of multimodality: intra-modality, inter-modality and trans-modality. Those instances, applied in relation to multimodal composing, allow us to understand three broad methods used to combine semiotic resources in a multimedia artefact beyond illustrative purposes – that is to say the intra-modal, inter-modal and trans-modal approaches helps us to understand how a multimedia artefact is a toolforthought. Applied in relation to scientific publishing, these three instances of multimodality are critical in order to define three multimodal integration strategies implemented in journals (see 4.2).

The three instances introduced below are therefore an attempt to put some order into the implicit meanings conveyed by the prefix *multi*. Our reading is based on two similar attempts in the context of discussing transdisciplinarity (Nicolescu 2008) and interculturality (Demorgon 2004).

1) A scientific multimedia artefact understood under the angle of *intra*-modality – the first instance - denotes a specific form of multimodality enacted within a dominant mode. Intra-modality is here close to the concept of monomodality defined by Forceville (2007). The dominant mode mostly remains the written mode - especially in scientific journals. This intra-modality is so deeply rooted that it is obvious and does not need further explanation. As for an example of this

"obviousness": In a scientific journal, a "multimedia section" is always expressly and explicitly identified in plain words in online scientific journals. The corresponding "words section" on the contrary would never be mentioned.

Intra-modality in this study describes then a type of multimodality enacted within the written mode of communication, approached as the predominant conveyor of meaning. A content displayed exclusively by means of written words (see Figure 5) can still be called multimodal because of the spatial organisation and the page formatting (paragraphs, character sizes, styles and fonts used to display the content).

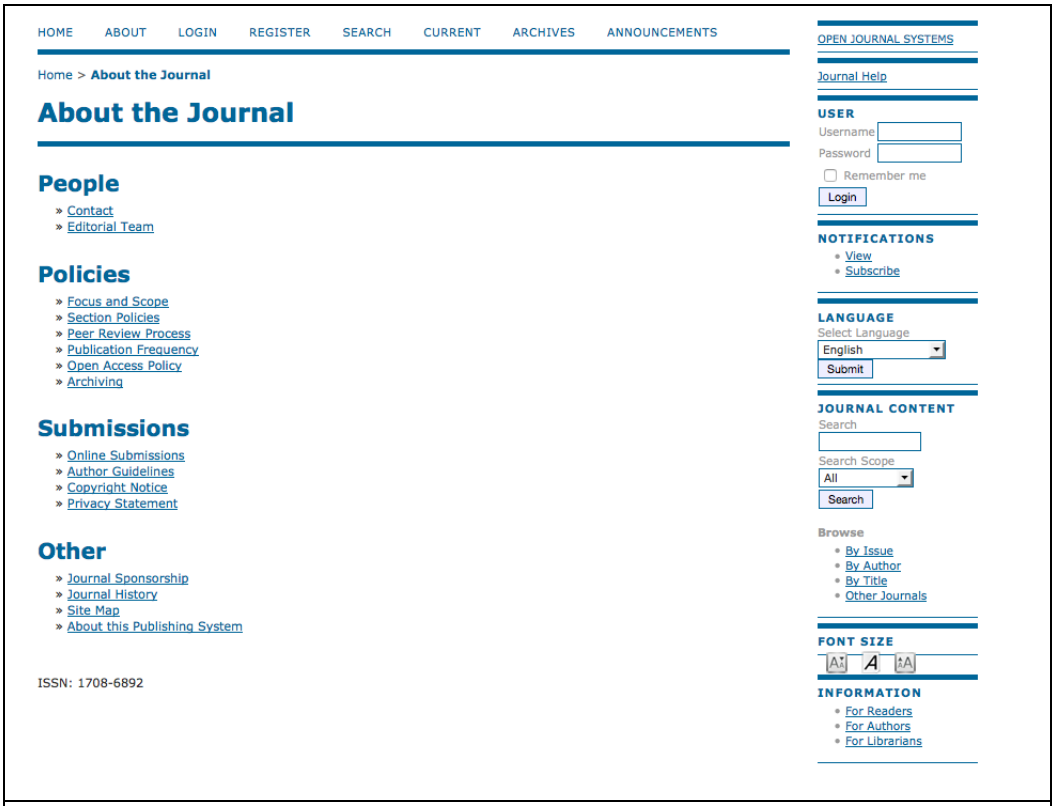


Figure 5: The Intra-modal Instance: Within the Textual Mode

2) *Inter*-modality - the second instance of multimodality - takes place between modes of communication and representation (see Figure 6). According to Bonde, two criteria can be used to describe how modes interact in a multimedia artefact. The first one concerns "the degree of separability and self-sufficiency of the modes; that means, to which extent are the interacting modes recognizable individually" (Bonde 2008:1). Four categories are distinguished: transposition, juxtaposition, combination, and fusion. The second one "refers to the degree of

denotational similarity and difference between the modes" (Bonde 2008:2). Three categories are distinguished in this case: the modes "may be consistent, contrary, or even contradictory" (Bonde 2008:2).

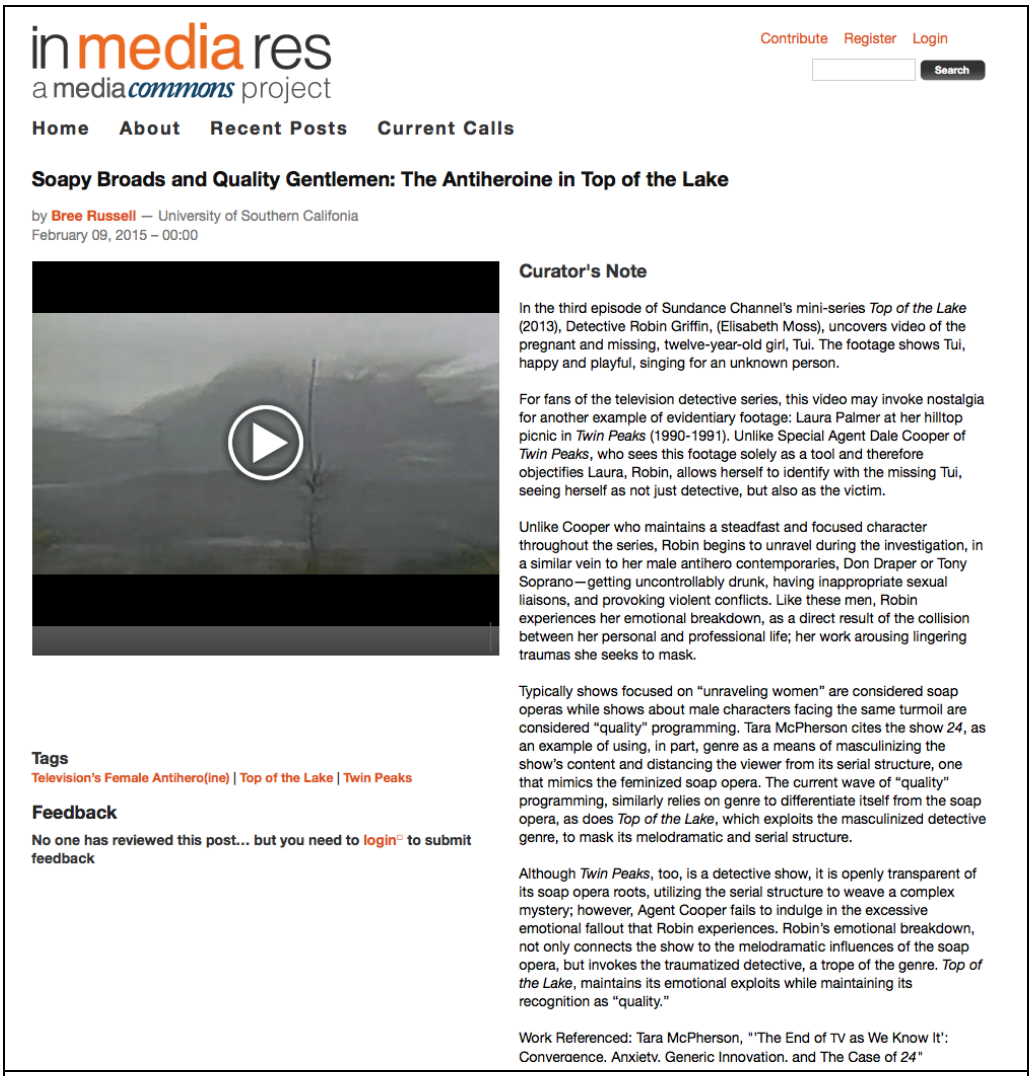


Figure 6: The Inter-modal Instance: a Video vs. a Text (IMR Clip 2015)

In the field of multimodal studies (O'Halloran and Smith 2010), situations of interaction between the visual and the written modes are typically analysed. For instance, Folker et al. investigate "written text with accompanying illustrations" (Folker et al. 2005:690). Childers and Lowry analyse the process of "connecting visuals to written text and written text to visuals in science" (Childers and Lowry 2005:n.pag.). Knox focuses on "visual-verbal communication on online newspaper home pages" (Know 2007:19). Wahlster et al. show "how Language Production is influenced by Graphics Generation" (Wahlster et al. 1991:n.pag.).

Finally, Lemke is interested in "visual and verbal semiotics in scientific text" (Lemke 1998:87). Still explicitly linked to scientific publishing, Banks (2009) considers how images are integrated in *Philosophical Transactions*, one of the presumably first scientific journals, together with the *Journal de Sçavans,* launched in March 1665.

Examples of inter-modality found in conventional scientific articles include still images complementing a full page of written words (juxtaposition) or a graph that remains to be explained and announced by means of written words in the body of the text (transposition).

3) *Trans*-modality, the last instance, is close to hypermodality as defined by Lemke: it "is more than multimodality in just the way that hypertext is more than plain text. It is not simply that we juxtapose image, text, and sound; we design multiple interconnections among them, both potential and explicit (Lemke 2008:300). Dicks et al. further explain indirectly the meaning of the prefix *trans* by re-using the term "traversal" also borrowed from Lemke:

> When we combine different modes through different media, and link these together in various ways, what kinds of new, multisemiotic meaning are produced? Hyperlinking means that multimodality becomes even more complex. In hyperlinking, we are no longer talking simply about the juxtaposition of image, text and sound, but the creation of multiple interconnections and pathways (or traversals) among them, both potential and explicit. This is the new meaning-potential afforded by hypertext + multimodality, and it is what Lemke (2002: 300) calls 'hypermodality': 'the new interactions of word-, image- and sound-based meanings ... linked in complex networks or webs' (Dicks et al. 2006:94).

In our view, and to use Dena's title, trans-modality is "the practice of expressing a fictional [or non-fictional, *added*] world across distinct media and environments" (Dena 2009:n.pag.) (see Figure 7). In the context of trans-modality, designing a multmedia artefact …

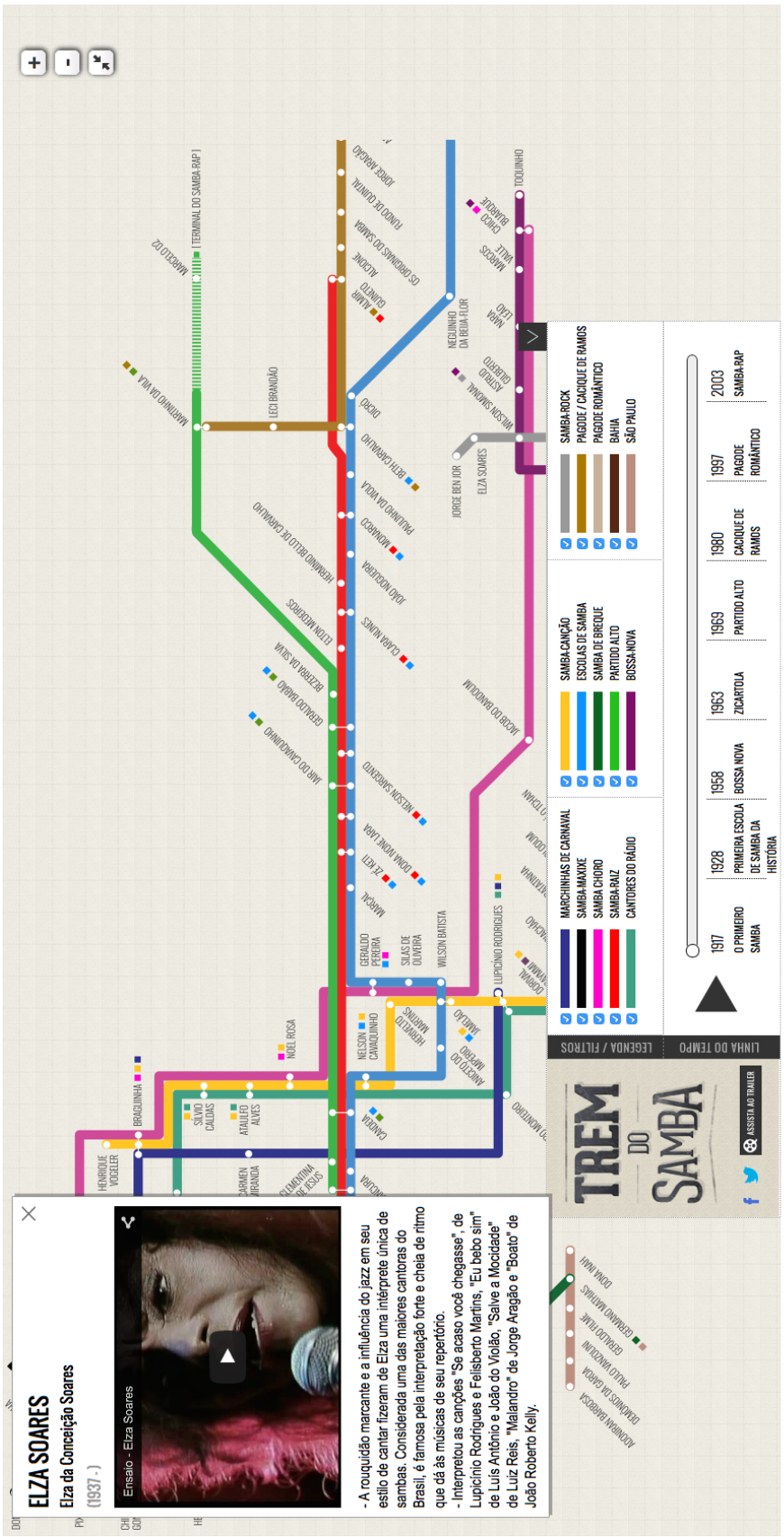


Figure 7: The Trans-modal Instance. *Trem Do Samba*, An Infographics (TDS 2012)

> … means interacting with a range of inscriptional toolforthoughts: artifacts that expand traditional forms of writing (such as the Web), but also modes of communication that were not previously available (such as interactive multimedia), or were available but not in the form of writing technologies (such as immersive role-playing simulations) … In virtual culture, writing creates a world on the computer—a world that provides both a "text" and the experiences needed to understand it. Simulations give students the potential to learn through a new form of direct experience… (Shaffer and Clinton 2006:295).

As can be noticed, trans-modality involves ultimately that a multimedia artefact is not approached as a disembodied mode but experienced as an embodied or re-embodied mode. Norris explains in relation to print the alternations between embodiment and disembodiment as follows:

> Boundaries are fuzzy, but generally print is an embodied mode when a person is employing it as an extension of their own body, i.e. writing, drawing, or painting something. But once the object is created, it has taken on a life of its own and people utilize the created, printed objects as a disembodied mode (Norris 2004:45-46).

To conclude, it can be argued that the 'intra-modal', 'inter-modal' and 'trans-modal' instances of multimodality just defined, based on an analysis of the prefix multi-, can be identified in relation to a specific spatial organisation of a multimedia artefact as it appears on the screen. In a nutshell, a multimedia artefact resulting from an intra- or inter-modal approach to composing will be presented in a linear way, whereas a multimedia artefact resulting from a trans-modal approach, will be presented in a modular way. This simple indicator should not obscure the fact, nevertheless, that distinguishing between modularity and linearity in order to circumscribe a specific reading path (Kress 2005) associated with a specific multimedia artefact should be, sometimes, problematic. The typical modularity of a multimedia artefact associated with a trans-modal approach, for instance, involves also certain forms of linearity due to its inclusion of written words. Conversely, a linear article disseminated online

can also be read in a "modular" manner due to its visual structure and its spatial organisation.

After analysing the process of designing a multimedia artefact as assembling semiotic resources together, in the following section, the same process is interpreting as a process of resemiotization.

2.3. A Continual Process of Resemiotization

After defining different types of multimodalities, the wide range of processes of "selection, transformation and transduction" (Kress in De Saint-Georges and Weber 2013:129) – i.e. the "use of modes … and their change from one mode to others" – is the last aspect to be discussed in relation to the 'digital multimodality' term of the equation to solve in this study. This last aspect is about how knowledge is reconfigured "when 'it' is moved from one mode to another [and ultimately] about the production of 'scientificness'" (Kress in Jewitt and Kress 2003:173). In a first subsection, various processes of transformation and translation of semiotic resources are introduced. They are understood as different variations of a general process of resemiotization (2.3.1). In a second subsection, the production of 'scientificness' – that is the design of a scientific multimedia artefact - is analysed as a series of processes of resemiotization occurring during the research process.

2.3.1. The Notion of Resemiotization

A variety of terms describe the "processes of change to representations" (Bezemer and Kress 2008:169) and the semiotic work involved in these processes. Bezemer and Kress distinguish between transformation and transduction: "One, transformation, involves changes within a mode; in the other, transduction, semiotic material is moved across modes, from one mode (or set of modes) to another mode (or set of modes)" (Bezemer and Kress 2008:169).

Following this line of reasoning, a translation could be defined as a process of transformation within a mode but relating to language. Da Silva discusses "re-textualisation" (Da Silva 2008:327) or transformation within the verbal or

textual mode across genres. Leppänen et al., in a discussion related to social media, focus on "re-uses of language and textual material as resources in meaning-making" (Leppänen et al. 2013:7), and analyse different "recycling" phases that lead from de-contextualisation to re-contextualisation and en-textualisation… A cinematic adaptation of a novel can also be viewed as a transduction. Dos Santos Cunha (2010) talks in that case of "intersemiotic translation" (Dos Santos Cunha 2010:340), De Siqueiras Freitas of displacement (De Siqueiras Freitas 2010:n.pag.)

In relation to design, Toomlinson draws on the work of Mavers to address issues related to "transmodal redesign in music and literacy" and the process of "moving meaning across modes or learning domains" (Toomlinson 2014:09). Adami uses the term "re-modalisation", that is "multimodal re-signification" (Adami 2011a:49). Finally, interpretation can also be considered as a specific process of transduction. Varga, from this perspective, discusses "automedial and allomedial forms of interpretation, i.e. interpretations which use the same medium as the artwork and interpretations which are in fact transpositions of an artwork into another medium" (Varga 2004:183).

Such examples could be multiplied as far as evoking an independent field of multimedia translation (Gambier and Gottlieb 2001) including issues relating to audio-visual translation and the semiotic work of the screen translator. In the present work and in relation to multimodal publishing, all of these processes - despite the important nuances that each of them emphasises - are treated as the same process of resemiotization occurring during the different steps of the research process and leading eventually to the dissemination of a scientific multimedia artefact. Resemiotization "is about how meaning making shifts from context to context, from practice to practice, or from one stage of a practice to the next" (Iedema 2003:41). It involves a series of recontextualisation and re-modalisation as well as a "chain of materialization processes" (Bezemer and Kress 2008:172). For instance, "the shift from talk to writing was one where the original face-to-face interaction becomes rematerialized in a less ephemeral way as printed writing" (Iedema 2003:42).

The notion of resemiotization allows for an understanding of the research process in the context of a specific activity system (Engeström 1987) dedicated to generating knowledge. This activity system in relation to formal publishing in journals is linked to a specific semiotic work or a specific process of resemiotization: a specific directionality is introduced in the chain of production of a scientific article that tends to transform the "multimodality of the field" (Dicks et al. 2006:79) through different stages of re-contextualisation, re-signification and re-materialisation. It is suggested in this work that, in the case of conventional (online or printed) journals, the process of resemiotization is preferentially oriented in a direction that favours the written words associated with static visual contents like tables, graphs, diagrams and still pictures, or also mathematical notations. On the contrary, in multimodal journals, the process of resemiotization is oriented in a direction that favours the use of a variety of semiotic resources.

2.3.2. From the Field to the Lab and from the Lab to the Screen

Resemiotization "is meant to provide the analytical means for (1) tracing how semiotics are translated from one into the other as social processes unfold, as well as for (2) asking why these semiotics (rather than others) are mobilized to do certain things at certain times (Iedema 2003:29). The process of resemiotization linked to the research process is divided into two simplified steps (see Figure 8): from the field to the lab and from the lab to the screen. Using ethnography as an illustration, from the field to the lab, "the multimodality of the field" (Dicks et al. 2006:94) – that is to say all the semiotic resources present in the field – and the "researchers' multimedia recordings" (Hurdley and Dicks 2011:286) are distinguished. Recording data is therefore the major process of resemiotization occurring during this first step. It can be noted here that the "multimodality of the field" (Dicks et al. 2006:94) – the phenomenal world – is never fully recorded because it is about the "more than textual, multi-sensual worlds" (Lorimer quoted by Vannini 2014:3). The multimedia recordings are the result of numerous and simultaneous processes of re-contextualisation of "the multimodality of the field". They are always already "translations" of the

phenomenal world that is observed in a certain way by a researcher whose presence changes the field. This is true even in the case of a "neutral" observer or a video recording (see in that regard Devereux 1967 about the principle of uncertainty). Multimedia recordings encompasses various types of semiotic resources assembled together, which are, among others:

- Empirical "multimodal data" (Coffey et al. 2006:24) embedded in different media, such as "images, sounds, written records" (Dicks et al. 2006:79) collected and/or produced during fieldwork;
- "Complex multimedia data sets with still and/or moving visual, audio and written texts" (Flewitt 2011:295);
- "Non-verbal and material forms of sensory data" (Dicks et al. 2011:234).

After the "multimodality of the field" and the multimedia recordings, by moving from the lab to the screen, the multimodality present in the research materials and the multimodality present in the article published, for instance, in a journal are distinguished. The multimodality of the research materials is linked to the notion of literary inscription: "The production of a paper depends critically on various processes of writing and reading which can be summarised as literary inscription" (Latour and Woolgar 1986:76). The process of resemiotization consists here in "the continual generation of a variety of documents" (Latour and Woolgar 1986:151) or multimedia research materials that serve the purpose of analysing and interpreting the multimodality present in the recorded multimedia data. In this category are included, for instance, the transcriptions of the audio-visual recordings. As a process of resemiotization, transcription is also based on a contradictory principle of "gains and losses" (Kress 2005:5):

> The term 'transcription' indicates in its name the route from sound to script, from speech to writing; and it points to the many problem in the transposition of material from speech to a written form. For one, the alphabet is an enormously limited resource for 'capturing' the vast potentials of sound, socially shaped, in the many affordances of speech. Only a small fraction of these can be 'transcribed' / 'transposed' into script by means of letters. That which appears in transcriptions is never that which was there in the interaction: it is an always massively reduced account (Kress 2011:254).

Latour and Woolgar summarize the process of resemiotization leading to the transformation of the multimedia recordings into multimedia research materials by means of "inscription devices" (i.e. transcription, among others) in the following way:

> One important feature of the use of inscription devices in the laboratory is that once the end product, an inscription, is available, all the intermediary steps, which made its production possible are forgotten. The diagram or sheet of figures becomes the focus of discussion between participants, and the material processes which gave rise to it are either forgotten or taken for granted as being merely technical matters (Latour and Woolgar 1986:63).

Finally, the published multimedia artefact is linked to the dissemination of the research findings and then to specific processes of resemiotization of the multimedia research materials. The transformation of the multimedia recordings and/or the multimedia research materials into the final published multimedia artefact depends – especially in scientific journals – on editorial policies and therefore on a defined multimodal format: traditionally, a maximum word count, a maximum number of pages, figures, graphs, etc. This multimodal format influences the use of specific semiotic resources in a submission.

This description of the process of resemiotization occurring during the research process in two simplified steps (from the field to the lab and from the lab to the screen) raises two further questions. First, how are semiotic resources other than written words and static visuals integrated in a scientific multimedia artefact that meets scientific requirements and standards? And second, how are the initial multimedia recordings and the final published multimedia artefact related to each other? In other words, "how [are] modes of collecting and laboratory practices transferred to web-based settings" (Beaulieu 2010:463)? These questions are discussed at length in the chapter three, in relation to formal scientific publishing in journals. They are then addressed in chapter four, through an empirical analysis of a sample of scientific multimedia and multimodal journals.

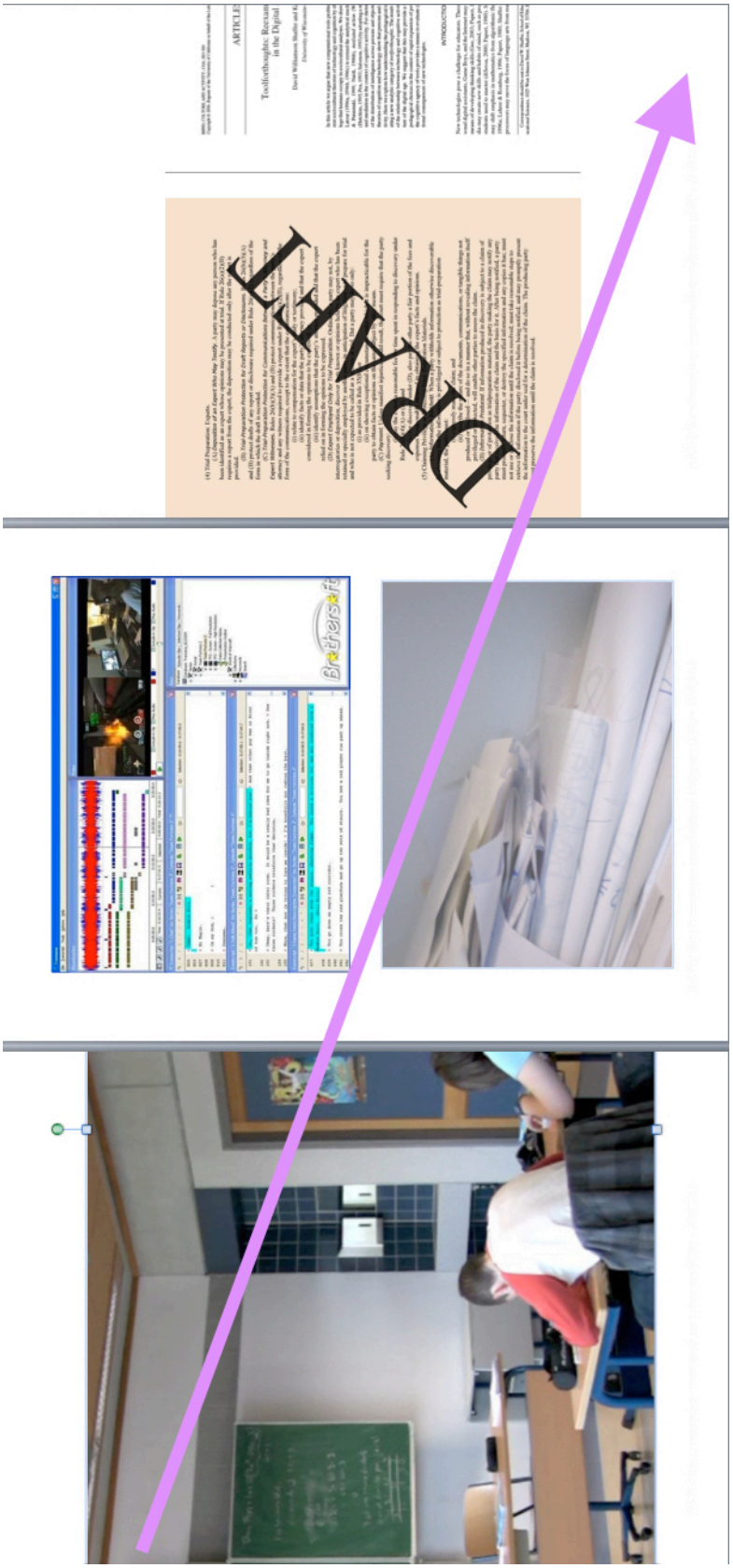


Figure 8: The Process of Resemiotization (From the Field to the Lab and From the Lab to the Screen)

3. The 'Scientific Publishing' Term of the Equation

The previous chapter introduced two interdisciplinary research fields – composition studies and social semiotics – that help characterising the 'digital multimodality' term of the equation to solve in this study (digital multimodality + scientific publishing). It defined five key notions (design, semiotic resource, multimedia artefact, publishing environment, and resemiotization) that will serve to analyse, in chapter four especially, multimodal approaches to scientific publishing in scientific journals. Overall, the chapter dedicated to the 'digital multimodality' concluded that a scientific multimedia artefact should be understood as a "toolforthought" (Schaffer and Clinton 2006:283). This is, at the same time, an object and a project. In other words, designing a multimedia artefact for scientific purposes goes beyond is not only about assembling various semiotic resources together (based on an intra-modal, inter-modal or a trans-modal integration strategy) but also about overcoming "the rupture between visibility and reality" (Pink 2007:33) through a continual process of resemiotization of the "multimodality of the field" (Dicks et al. 2006:94). From this perspective, it can be argued that digital, multimodal scientific publishing differs from printed scientific publishing because reality, in the former case, is not only made readable as a text but also made visible, sensible, audible etc. – i.e. intelligible – as a dynamic and interactive multimedia artefact and through a variety of modes not accessible in traditional publications.

Digital technologies therefore enable opportunities for revisiting the different stages of the process of resemiotization occurring during a research study. They enable opportunities for revising how, on the one hand, the "multimodality of the field" (Dicks et al. 2006:94), the multimedia recordings, the multimedia research materials and the published multimedia artefact are connected to each other in a scientific publication and how, on the other hand, multiple semiotic resources beyond words and static visuals can be integrated in a published article. In sum, the 'digital multimodality' term of the equation questions how the visual, auditory etc., all the multimodal aspects of a culture, an event or a field are made

visible, audible, etc. in a scientific article taking advantage of digital affordances. With this, it is also questioned how visually and aurally, etc. and not only textually it is expressed or designed. Kress explains that

> the two kinds of tools at issue here … are 'modes' and the digital media: 'modes' are tools for making meaning in representation, now frequently discussed under the heading of multimodality; the digital media are tools for the production and dissemination of 'messages'. The two form an integral, mutually interacting partnership – as media and representation have always done (Kress 2011:246).

These same issues are now discussed, in a complementary perspective, in the context of two other interdisciplinary research fields – genre studies and information studies. Together these two interdisciplinary research fields help to describe the 'scientific publishing' term of the equation and more specifically the particular challenges that are raised by multimodal scientific publishing. In the first section of this chapter, the field of genre studies is introduced and the distinction between genre and format is specified. In line with this development, the second section points out the stability of the scientific article genre over time. In a third section, the field of information studies is then presented and three interrelated notions are scrutinized: information, knowledge and data. In a last section, the scientific communication system (and its different phases) is described.

3.1. Designing a Scientific Multimedia Artefact

The field of genre studies – the third source of information used in this study – is associated with the 'scientific publishing' term of the equation to solve. The main reason for doing so is that a genre is defined, among other criteria, in relation to a set of conventions. From this perspective, the scientific research article genre is no different: it is made of normative, more or less crystallised, standards. These standards or conventions are the result of a long history. In sum, the process of designing a scientific multimedia artefact for publication in a scientific journal has also to be understood in relation to the scientific research article genre.

In the following subsection, the notion of genre and format are distinguished (3.1.1). Whether published as a traditional linear paper or on screen as a multimedia artefact, it is argued that a scientific research article remains largely the same from the viewpoint of genre. This seems to be the case even if it is possible to describe different types of print, digital and multimodal formats that are related together in some way. In line with this reasoning, the second subsection shows that the current digital scientific research article disseminated online is based on a "print format" (Guay 1995:n.d.) that is reproduced or partially updated (3.1.2).

3.1.1. The Notion of Format and the Research Article Genre

Drawing on the work of Berkendotter and Huckin, Caballero defines genres according to the following traits: 1) situatedness, 2) community ownership, 3) duality of structure, 4) form and content, and 5) dynamism. (Caballero 2008:18). The first two "traits" – situatedness and community ownership – are linked to the conventional aspects of a genre, its belonging to a community, in this case the scientific community, and its contribution to stabilising and perpetuating the structures and practices of the community.

We associate the next two traits – duality of structure and form/content – with the IMRaD structure of the research article – that is the "customary names of the major sections in such articles: Introduction, Method, Results, and Discussion (O'Neill 2001:247). Even though the adoption of the IMRaD structure is subject to slight variations in different scientific disciplines (see for instance Sollaci and Pereira 2004; Szklo 2006), it seems nevertheless to characterize a structural norm (O'Neill 2001:247; Sharp 2001:12; Linkov et al. 2006:596;) that defines the research article in general: "Unlike a novel, a newspaper article or an essay, a RA [research article] has a required structure and style, which is by international consensus known as 'Introduction Methods Results and Discussion' or IMRaD (Hengl and Gould 2002:1).

The last trait (dynamism) reported by Caballero (2008) will be introduced with the help of a quote. As Björk et al. (2009) remind us a research article is often

referred to simply as a "paper" and associated mainly with a specific semiotic resource – that is written words:

> By Scientific Journal Paper we mean a paper describing scientific research results, which has undergone some form of anonymous peer-review and which is published in a regularly appearing serial, usually by a third party publisher and not by the university of the author. Journals fall into the science, technology and medicine category as well as social science and the humanities … Papers are typically 3,000 to 10,000 words in length and are written following long-established conventions concerning style, referencing, tables of content etc. Other types of scientific publication include conference papers, book chapters, books and reports (Björk et al. 2009:n.pag.).

As can be seen in the previous quote and as it is the case for most of the main notions used in this work, definitions linked to scientific publishing refer implicitly or explicitly to print publications ("papers") and to written words by default. It is then necessary to adjust the previous definition by saying that a scientific multimedia artefact published in a journal would be also described as a research article if it undergoes, as it is the case for a traditional paper, some form of peer review. Moreover, a scientific multimedia artefact would belong to the scientific research article genre if it reproduces online, in some way, the IMRaD structure and follows other scientific conventions. In other words, the "only" difference is the use of a multimodal format including a broader range of semiotic resources.

The notion of format is therefore linked to the last trait defining a genre mentioned by Caballero (2008): a genre is dynamic (cf. supra). Tanselle (2000) at the beginning of his exploration of the concept of format points out that "a precise definition of this particular concept … is remarkably elusive" (Tanselle 2000:69):

> Perhaps the most common such term is "format," which has spread far beyond its application to books: people speak of the format of a television show or a ceremony, where the term refers to the nature and order of the contents. Even when it is applied to printed matter, it sometimes carries this sense; magazine

> editors, for example, when they talk about the formats of their magazines, may well be referring to the kinds of material included and to the ordering of the items. They might, however, mean the layout, typography, and overall dimensions of the journal; and nearly everyone follows the software makers' practice of using "format" to mean the spatial arrangement of an electronic text as it is displayed on a terminal screen or on paper (Tanselle 2000:68).

The same description of the situation regarding the uses of that notion can be made in relation to scientific publishing. Schaffner in an article dedicated to the "future of scientific journals" (Schaffner 1994:239) alternatively talks about the *format* of individual articles, the traditional *format* of the article and the *format* of the journal. Bachrach distinguishes between "two readily available and simple formats for saving documents" (Bachrach 2001:n.pag.). Harnad and Carr evoke "the format of open archiving [and] the full range of variation in citation formats" (Harnad and Carr 2000:632). Kenney et al. analyse the "archival format [and notes that] the National Library of Medicine (NLM) is undertaking an effort to identify journals that have gone to an electronic-only format" (Kenney et al. 2006:5). Szklo refers to the IMRaD structure as the "format favored by most epidemiologists and empirical researchers in the biomedical field since the 1970s" (Szklo 2006:32). Esposito, more recently, describes "a new format for the born-digital publisher" (Esposito 2011:n.pag.) while Palter, also in a blog post, announces, "New multimedia article Format revolutionizes medical research" (Palter 2012:n.pag.). Finally, Newton gives an account of an editorial project called Palgrave Pivot as, "an innovative format for scholarly research" (Newton 2013:70).

These and other variations are indicative of the explorative aspect of a format in general. In other words, they make evident that a format, understood as a set of social rules and/or as a structure, can be experimented, changed and readjusted over time. Consequently, the notion format is associated closely in this work, with the notion of semiotic resources: more precisely and in relation to scientific journals, a format is an answer to the following questions: 1) which semiotic resources can be used in a research article; and, 2) which combination of semiotic resources can be used. A format can be predefined by the editorial

board of a specific journal or negotiated during one of the phase of the publishing cycle. In any case, however, a scientific multimedia artefact, whether based on a multimodal format or not, remains first and foremost a scientific research article (it belongs to a specific genre). Again, as concrete examples from scientific journals will show in next chapter, due to the fact that multimodal scientific publishing is not yet linked to a common practice and to the established research article genre primarily defined in relation to print and mainly written words, a multimodal format is almost always expressly and deliberately mentioned or described in plain words in a journal. An abstract that makes use of a video or graphics will be therefore emphasised as a *video* abstract (NJP Abstract n.d.) or a *graphical* abstract (ELSEVIER Abstract n.d.), while the label *textual* abstract would seem redundant or unnecessary. A scientific article, still within the same logic, is then a "*multimedia* article" (Guaraná 2010) or a "*video* article" (the format promoted by JoVE, see 4.3).

In sum, distinguishing between genre and format provides a tool that allows explaining how genres, and scientific genres in particular, are maintained online whereas their formats are reproduced, adapted or transformed. The notion of format, as an examination criterion, can also be used to distinguish between multimodal scientific journals and (online) scientific journals. In the following quote, according to our understanding of the notion of genre, "genres" should be substituted for "formats":

> They account for three sets of genres: (a) reproduced genres (which show no changes with regard to the print originals), (b) adapted genres (which go beyond their original purpose(s) thanks to the new technologies like, for instance, online newspapers or multi-page documents where we can find a book review linked to an online store), and (c) new genres unique to the new medium (e.g. hotlists or weblogs) (Caballero 2008:22).

In consequence, the first category ("reproduced" or print format) would refer to a research article disseminated online, that reproduces the printed format of an article. In terms of semiotic resources, it is made up of written words and static visuals. The second category ("adapted" or digital format) would comprise of

research articles with a format taking advantage of the affordances of the Web – for instance, it is made up of hyperlinks but globally remains the same. In our view, these first two categories are representative of online scientific journals. Finally, in the last category ("new" or multimodal format), a research article would be based on a format that has no printed equivalent from which it is derived. Due to obvious technological constraints, it is not possible to disseminate, for instance, a printed video research article. In this third case, a change of the format, e.g. of the content structure (with a variety of semiotic resources) can lead to a major change of an established genre. It is stated in this work, that a multimodal scientific journal will especially be build around a new digital format with no printed equivalent (see Chapter 4).

In the next subsection the characteristics of a digital artefact are discussed first in order to describe the specificities of a digital research article based on a digital format in comparison to the properties of a conventional research article on which the "print format" (Guay 1995:n.pag.) is historically derived (3.1.2). The characteristics of a digital scientific artefact will be further analysed in the second section of this chapter in order to question the relationship between digital and multimodal formats (3.2). The central issue at stake is to explain whether the "multimodal affordances" (Villanueva et al. 2008:n.pag.) are another set of features related to digital formats, as the "hypertextual affordances" (Villanueva et al. 2008:n.pag.) are – or whether these set of features need to be understood in relation to unique formats, that is multimodal formats, contributing eventually to the emergence of new genres, and specifically new scientific genres, linked to specific new publishing practices developed in multimodal journals.

3.1.2. The Digital Characteristics of the Scientific Research Article

Various attempts summarised by Kallinikos et al. (2013: 359, Table 1) describe how "digital artifacts differ from physical entities and other cultural records (e.g., paper-based files, tape recordings) of non-digital constitution" (Kallinikos et al. 2013:358). Most authors agrees that digital artefacts "are embedded in wider

and constantly shifting ecosystems such that they become increasingly editable, interactive, reprogrammable, and distributable" (Kallinikos et al. 2013:357).

The first characteristic of a digital artefact – editable – is described in the following way: "Digital objects are in a constant stage of flux as they are contingent to being modified and updated. Their content or elements can be changed or deleted; new elements or modules can be added ex-post. A telling example is a Wikipedia article page" (Márton 2010:64). The second characteristic – interactive – is the fact that a digital object offers "alternative pathways along which human agents can activate functions embedded in the object, or explore the arrangement of underlying information items" (Kallinikos et al. 2013:358). Márton contextualises this interactive functionality in relation to a 3D-object and a video games: "A state-of-the-art 3D computer game, for instance, presents such a high level of visual immersion and navigation that the gamer literally can explore the world s/he is playing in" (Márton 2010:64). The third dimension – "openness or reprogrammability" (Kallinikos et al. 2013:359) – "refers to the potentiality of digital objects to be modified in ways unintended by the creators or designers" (Márton 2010:64). The last property – distributedness or transfigurability – emphasises the fact that digital artefacts are "distributed and are thus seldom contained within a single source or institution" (Kallinikos et al. 2013:360).

It can be concluded from this quick overview that, at first glance, all the four main qualities or characteristics of a digital object contradict "the familiar main functions of scientific communication – the registration, awareness, certification and archive functions" (Roosendaal and Geurts 1997:14). Indeed, due to the archiving function a scientific research article is not open or reprogrammable: it can and should not be modified by a reader, a user or a colleague. Moreover, it is rarely or never updated and even less deleted after it has been peer reviewed and published: a scientific article is not editable. Third, in general a scientific article is linked to a specific issue of a specific journal of a specific institution: it is not distributable either because of the registration function of publishing in scientific journals. Finally, a scientific article is interactive only to a limited

extent: hypertexts may allow browsing the content of an article and hyperlinks to directly access the references.

To support this view that there are principal tensions between digital characteristics and traditional properties of scientific publications, a review of four recent studies is proposed in the following. All of them aim to understand the digital characteristics in relation to online scientific publishing and therefore investigate how scientific journals deal with these features that, at first glance, do not match with the traditional functions of a scientific article. It must be noted that these studies are dealing rather with *multimedia* than with *multimodal format* or *semiotic resources*. However, *multimedia* is the term commonly used by scholars analysing the development of scientific communication or publishing. Here is the list of the four studies:

Mackenzie Owen	2010	The scientific article in the age of digitization
Córdoba and Coto-Solano	2008	The characteristics shared by the scientific electronic journals of Latin America and the Caribbean
Mayernik	2007	The prevalence of additional electronic features in pure e-journals
Simeão and Miranda	2004	Comunicação extensiva e o formato do periódico científico eletrônico.

As can be noticed, the four studies under scrutiny cover a six-year period from 2004 to 2010. This period of time is marked by the creation of countless online scientific journals (Morris 2007; Oppenheim 2008). These studies are based on empirical, quantitative and/or qualitative analysis of effective publishing practices of existing online scientific journals and do not develop, as it is otherwise often the case, discussions dedicated to the "future" of scientific communication in relation to the digital mode of distribution.

All four studies mention four digital characteristics shared by scientific research articles published online:

- First, a scientific research article is navigable or clickable. "Navigation" (Mackenzie Owen) or "nonlinearity" (Córdoba and Coto-Solano) associated with hypertextuality (internal links) and hyperlink associated with "connectibility" (external links) are distinguished in three of the four studies

(Córdoba and Coto-Solano, Mackenzie Owen, Mayernik) (See next characteristic).

- Second, a digital article is connectible or linkable. Mayernik as well as Córdoba and Coto-Solano use the expression "multiple use" for describing this attribute allowing connecting a digital article with other external sources, documents or environments. Simeão and Miranda subsume this characteristic under hypertextuality.
- Third, a digital scientific article is interactive or responsive: it allows comments posted by users or readers and then a direct contact with the author or the publication.
- Finally, all four studies indicate multimedia integration as a potentiality ("Multimedia", Mayernik; "Use of multimedia", Córdoba and Coto-Solano; "Hypermediation", Simeão and Miranda; "Multimedia content", Mackenzie Owen). The digital article incorporates semiotic resources beyond written words and static images or graphs, such as video or sound.

Three other properties are explicitly mentioned only in the study conducted by Mackenzie Owen:

- A digital article is flexible ("flexibility", Mackenzie Owen) means that besides assimilating and incorporating new bits of information, the digital artefact can accommodate new information. In other words, it has the potential to be updated as well as reformatted by authors or editors. Flexibility can be understood in terms of format attributes such as length (a scientific research article is not limited to a certain number of words and graphs) or font…
- To expand on the same discussion, a digital scientific article is customizable and adaptable ("reader control", Mackenzie Owen). It means that readers/users could ideally reorganise the display of a research article to fit their personal reading environment or preferences.
- Interoperability is not explicitly can be added here as another variation of the adaptability signalled by Mackenzie Owen. The issue of interoperability gained importance over the last four years with the increasing adoption of various mobile devices, such as smartphones and tablets.

The following two properties refer to well-known aspects of digital distribution: "copyability" (Mackenzie Owen) and accessibility ("network connectivity", Mackenzie Owen).

- The dimension "copyability" poses specific challenges in relation to the problem of copyrighted material.
- The second property - a scientific research article is "accessible" online - is indirectly linked to the issue of publishing costs and then to publisher control. The dimension "accessibility" is also linked to a number of specific issues related to the dimension of time (storing, archiving and maintaining the archive of a digital scientific research article in the long run). Rapid technical obsolescence is of special concern for scientists due to the functions of scientific communication systems as previously noted, including long-term accessibility (see supra).
- Mayernik analyses "rapid publication" as another specific dimension of electronic publishing. In our view "rapid publication" is a complementary aspect of accessibility. A scientific article can be made almost immediately available for public comment in comparison to delays linked to print technologies.

The last few digital properties that need to be mentioned are linked to umbrella terms such as "added resources" (Córdoba and Coto-Solano) and "visibility" (Simeão and Miranda). The former is associated with "metadata" and "search engine"; the latter covers different aspects such as content renewal, network access, index databases and impact. Mackenzie Owen groups "navigation mechanisms, semantic linking, interfacing" together under the label "functionality". All of these characteristics are translated here in the following way: a digital scientific research article is searchable (its content can be explored by a search engine) and recognisable thanks to its digital identity. A number of aggregator services currently take advantage of these digital properties.

If all of the above mentioned characteristics are currently "shared by the scientific electronic journals" (Córdoba and Coto-Solano 2008), all the four studies conclude that these characteristics, at the same time, are not widely used or enacted, neither by authors submitting a contribution, nor by scientific

journals publishing a contribution. Mackenzie Owen, in analysing the most recent data and after conducting the most systematic study related to this issue, sums up this point and writes:

> Claims that 'the scientific journal will change considerably [towards a] new, more composite form as an ensemble of various textual and non-textual components' or that the scientific article will develop towards a new hypertextual form cannot be substantiated on the basis of this study. It might be argued that the lack of innovation of the scientific journal in digital form can be ascribed to a declining importance of the genre as such. But there are no indications that the role of the scientific article is diminishing, and the recent growth in numbers of new, open access journals serves to prove the continuing attractiveness of the genre (Mackenzie Owen 2010:224).

In most online scientific journals, a compromise seems to be adopted. The "print format" (Guay 1995:n.pag.), based mainly on written words, is whether reproduced online or partially updated. The scientific research article, disseminated online, is therefore not fundamentally changed. In the following section, some implications of this conclusion are first considered as regards the development of multimodal approaches to scientific publishing (3.2.1). The stability of the scientific article genre over time is then interpreted as regards the uses of verbal and non-verbal semiotic resources in sciences (3.2.2).

3.2. Making Use of Semiotic Resources for Scientific Purposes

The previous discussion on the properties of the scientific research article disseminated online suggest that the characteristics of digital artefacts as previously described (distributedness, openness, editability, interactivity) are adapted to the scientific needs and not the other way round. In other words, the digital scientific research article is similar to its print counterpart: "we would argue that it is the scientific community that creates the 'new medium' rather than that the new medium remediates and transforms scientific communication" (Mackenzie Owen 2001:219). Concretely this means that a research article published online is a digital artefact insofar as the digital dimensions do not

jeopardise the scientific research article genre and therefore the functions linked to this specific genre. In the following section, some implications of this conclusion as regards the slow development of multimodal approaches to scientific publishing and the poor use of semiotic resources beyond written words in current scientific journals are explored.

3.2.1. The Stability of the Scientific Research Article Genre

The stability of the scientific research article genre over time is suggested by mostly all empirical studies dedicated to online scientific publishing. This conclusion implies that a scientific article published online is first and foremost a scientific article that is delivered online and not an article produced online. To this respect, Mayernik indicates, for instance, that "the ability to publish rapidly appears to be a primary advantage of the electronic medium" (Mayernik 2007:n.pag.) for the scientific community. In other words, the digital environment is not primarily employed as a tool for designing a multimedia artefact but a distribution channel: "digitization functions as a new technology of distribution, again with little impact on the content of what is distributed (Owen Mackenzie 2010:225).

This aspect of scientific publishing seems to be directly connected to the poor integration of multimedia content in current online scientific journals on the one hand, and to the poor use of a variety of semiotic resources beyond written words in scientific articles, which implies a change in the mode of production, on the other hand: "multimedia features can be an asset in more fully expounding on an idea, but these were seen in low incidence" (Mayernik 2007:n.pag.). Mackenzie Owen, in a similar way, concludes "that the multimedia capabilities of the digital format are not regarded as essential by most e-journals, and that authors are not inclined to include multimedia content in their scientific writings" (Mackenzie Owen 2010:173). Córdoba and Coto-Solano, still in a similar manner, point out that "the sight of multimedia functions in the journals is almost non-existent" (Córdoba and Coto-Solano 2008:n.pag.). The poor integration of multiple semiotic resources in a scientific research article suggests therefore that the digital equivalent of the printed word is still regarded as the

major semiotic resource used to communicate formally in the scientific community. Swan (2006) justifies the primacy of written words in relation to the development of scientific publishing in journals:

> It is almost 350 years since the first scholarly journals entered publication … The use of the printed word became thereafter the primary, formal, means by which scholars have communicated the results of their work. It became the means, also, by which scholars established their right to the intellectual property reported in their articles, by which they claimed to be the first to conduct such work and present its findings, and by which some system of quality control was imposed upon the reporting of the results of scholarly endeavours through peer review of articles before their acceptance for publication (Swan 2006:5).

As can be deduced from the last reference, the close association between formal communications and scientific article based on written words has to be understood in relation to the main functions allocated to the scientific journal. These functions explain the stability of the scientific research article genre and why, above all, the "print format" (Guay 1995:n.pag.) is reproduced or adapted online. This explains also, by ricochet, why promoting multimodal formats is still not a top priority in scientific journals. Mackenzie Owen summarises this situation as follows:

> The scientific article is a re-writing of the research process and its results, with specific purposes in mind such as informing, registering, acquiring status and recognition, etc. … The article is not a 'literary' form that allows for experimentation and an individualized expression in terms of style, presentation and argumentation. It objectifies by abstracting both from the contingencies of research practice and from the self-expression of the author (Mackenzie Owen 2010:220).

Bazerman underlines, finally, a last important aspect of scientific writing that highlights why, in the final analysis, the scientific research article genre is closely associated with written words: if (printed or digital) word is the primary semiotic resource used by scientists, it is because a word in the last resort is not regarded as a semiotic resource at all:

> One peculiar aspect of the accomplishment of scientific discourse is that it appears to hide itself. We know that poetry, laws, and newspapers are the active products of word-hagglers. The only ploy to minimize human linguistic agency in these endeavors is to invoke divinity, muses, or the depths of the human psyche. Yet to write science is commonly thought not to write at all, just simply to record the natural facts. Even widely published scientists, responsible for the production of many texts over many years, often do not see themselves as accomplished writers, nor do they recognize any self-conscious control of their texts (Bazerman 1988:14).

To conclude this discussion, the following summary table (see Table 1) is an attempt to emphasise how the main digital dimensions (first column) contradict the main functions of scientific publishing (second column) and how a compromise is found in a majority of online scientific journals (third column). For instance, the interactive dimension of a digital artefact is reduced to hypertextuality in scientific journals. The editable dimension is reduced to commenting. It should be noted here that open access journals are based on a different publishing paradigm (see 5.1) and integrate the digital dimensions in a different way. They are not taken into account in the above summary table. It should also be noted that multimedia, in the context of scientific publishing, is most of the time approached as a property among other properties, and thus as a mere option. As Simeão and Miranda point out, there is no "direct relationship between … the [main] characteristics of the electronic format" (Simeão and Miranda 2004:595).

In the following subsection, a brief overview of visual and other non-verbal modes of communication, in science, is provided. It is intended to describe which types of semiotic resources that are not included in conventional printed scientific journals and/or scientific research articles for technical reasons could be reintroduced thanks multimodal approaches of scientific publishing.

Dimensions of a digital objet (Based on Márton 2010; Kallinikos et al 2013	**Functions of scientific publishing** (Based on Roosendaal and Geurts 1997; Sompel et al. 2004	**The properties of a digital scientific research article** (Based on Simeão and Miranda 2004; Mayernik 2007; Córdoba and Coto-Solano 2008; Owen Mackenzie 2010
INTERACTIVE The functions embedded in a digital object can be activated	**AWARENESS** Be aware of new claims and findings	**Non-linear (hypertexts)** An article is navigable and clickable (internal links). **Connectible (hyperlinks)** An article is linkable (external links) **Interactive** An article can be commented on.
EDITABLE A digital object can be constantly modified and updated or deleted	**ARCHIVING** Preserving and maintaining the scholarly record over time	**Customizable** An article can be read on screen (the HTML format) or printed out (the PDF format) **Flexible** An article can be updated in the case of an open and transparent peer-review process but not after it has been certificated and indexed.
DISTRIBUTEDNESS A digital object and or some of its components is distributed in various sources or institutions	**REGISTRATION** Precedence Reference	**Copyable** An article can be downloaded and stored on a personal computer **Accessible** An article is accessible under specific conditions. It is also re-usable under codified conditions. **Available** An article is immediately accessible for public comment under conditions
OPENNESS A digital object can be modified in ways unintended by creators or designers	**CERTIFICATION** Legitimacy Prestige	**Searchable** An article can be found by search engines **Recognisable** An article is static and certified
		Multimedia A potentiality of any digital document.

Table 1: The Current Digital Format of the Scientific Research Article

3.2.2. Visuals and Other Semiotic Resources in Scientific Communication

If written word is the main semiotic resource used to communicate formally in science, it does not mean, first, that a variety of other semiotic resources are not used during the research process and, second, that visuals of all kinds are absent from scientific publications. In this respect, Banks reminds us that "illustrations were used virtually from the very beginning" (Banks 2009:21) in the first scientific journal, *Philosophical Transactions* (1665). This subsection is dedicated to describing how multimodal formats could potentially re-integrate a variety of semiotic resources, linked to various research materials, used during the phases of the research process prior to the phase of dissemination in journal.

Three indicators could be defined in comparing a scientific research article published online and offline. The first is logically related to identifying which kind of semiotic resources, a research article is made up of besides the conventional written words, static visuals and graphics (tables, charts and still images…) and notations (mathematical, chemical, etc.): does it include sound/audio or software? Does it make use of videos, 3D objects and animations linked to kinetic modes of communication? The second indicator is related to processes of resemiotization (see 2.3.1) of multimedia recordings and other multimedia research materials used during the research process: how are all these semiotic resources re-contextualised? Finally, the third indicator is related to non-verbal sources (Mazzolini 1993) or other categories of semiotic resources a scientist might make use of in his/her publication:

> 1) scientific instruments in all their variety and uses; 2) models, such as models of the planetary system, of the earth, of the human body … of molecular structures, of machines and so on; 3) scientific illustrations of plants, … , geographical regions, of the sky, of planets; 4) classified collections of natural objects such as plants (herbals), minerals, … 5) the arenas of scientific communication and practice such as natural history museums, botanical gardens, laboratories, anatomical theatres, and observatories, where a functional architecture provides the physical conditions for specific forms of communication; 6) conventional representations including graphs and symbolic artefacts such as classifying

> schemes, graphic representations of laws, diagrams, table (such as Mendeleev's table), and other varieties of non-verbal symbolism which are present in a wide range of disciplines (Mazzolini 1993:viii-ix).

Most of these "non-verbal sources" are not included in conventional printed journals for obvious technical reasons and also for economic reasons. But in directing the attention to these sources, Mazzolini succeeds to suggest another meaning of the category "non-verbal". A scientific publication is also made of "un-verbalised" sources of information. The research process can be understood thus as a process of resemiotization that results also in a scientific research article made of silences, omissions and unsaid meanings (Dressen 2002). In other words, if a multimodal approach to scientific publishing allows re-connecting the different phases of the research process, especially the phases situated prior to submission with the dissemination phase, in doing so, the balance between "the 'said' and the 'unsaid' in scientific discourse" (Dressen 2002:81) linked to the use of written words, is also changed.

In sum, a multimodal approach to scientific publishing is an opportunity but also a risk. The "conventional omissions of research activity" (Dressen 2002:86), mainly associated with the written mode of communication, allows a scientist to keep a research under control. In contrast, the understanding of modal affordances related to other semiotic resources relies on multiliteracy skills that are not yet (or no more) fully developed from an educational viewpoint. If a scientific multimedia artefact (a research article) includes more broadly the multimedia recordings and the multimedia research materials generated during the research process, "a number of non-verbal sources may acquire a significance which originally was not intended, as in the case of those illustrations of extinct animals and plants" (Mazzolini 1993:xi). However, and at the same time, it can be argued that the multimedia recordings and the research materials, silenced in a conventional publication and that could be made available in multimodal scientific journals, are valuable resources as regards the issue of reproducibility, "one of science's defining features" (Open Science Collaboration 2012:657). For instance, the Reproducibility Project …

> … uses an open methodology to test the reproducibility of psychological science. It also models procedures designed to simplify and improve reproducibility. Readers can review the discussion history of the project, examine the project's design and structured protocol, retrieve replication materials from the various teams, obtain reports or raw data from completed replications, and join the project to conduct a replication (Open Science Collaboration 2012:659).

But giving access to a broader range of research materials thanks a multimodal approach to scientific publishing, in turn, is not devoid of concomitant ethical as well as technical considerations:

> Scientific communication relies on evidence that cannot be entirely included in publications, but the rise of computational science has added a new layer of inaccessibility. Although it is now accepted that data should be made available on request, the current regulations regarding the availability of software are inconsistent. We argue that, with some exceptions, anything less than the release of source programs is intolerable for results that depend on computation (Ince et al. 2012:485).

Based on this quick overview of uses of semiotic resources in science, following Marshall, it can be stated that "clear-cut publication rules prove elusive" (Marshall 2002:1625) and that a multimodal account of a research has to deal with a "multisemiotic noise" that must be closely monitored by specific procedures that match the objectives of the overall scientific communication system. This is the reason why information studies constitute the fourth source of information that allows addressing the challenges and constraints linked to multimodal scientific publishing.

3.3. Evaluating and Disseminating Scientific Multimedia Artefacts

The last established interdisciplinary field that informs the present study is the field of information studies. As a reminder, the field of social semiotics points out that a variety of semiotic resources are usually used to make and communicate meaning and not only written and spoken words. Each of these semiotic resources can be used as a meaningful tool allowing communicating certain types

of information due to specific affordances and thus contribute to generate and shape knowledge. The field of composition studies indicates in a complementary manner that composing a multimedia artefact is more than writing and more than integrating various semiotic resources in a written piece of work. It means properly designing a coherent ensemble in which semiotic resources interact with other. The field of genre studies highlights how, in the scientific community, written words are used generally as "natural facts" (Bazerman 1988:14). In other words, a scientific research article, in contrast to a multimodal publication, is not *a priori* a space for experimentation or exploration inviting contradictory interpretations and readings. It is dedicated to a conventional and formal dissemination of research findings based on an attempt to maintain control over a message and the way it is consumed. This aspect is linked to social and systemic factors that information studies help taking into account and that are discussed in the present section.

Under the label of information studies various fields come together, such as computer science, information science, and information systems. These fields and associated research areas deal with the dissemination of information or data, from a technological point of view and from an organisational and human point of view as well. Issues, such as online accessibility, availability and readability of digital objects in the long term, addressed by these research areas, are of primary importance, when it comes to the dissemination of scientific knowledge and to a system that is largely based on its capacity to archive and reuse information over long periods of time.

In a nutshell, the systemic view provided by the field of information studies, first, helps understanding how introducing a change (in this case, storing, retrieving and disseminating scientific multimedia artefacts) in a system (in this case, the scientific communication system) implies significant changes in all the consecutive stages of a production process (see 3.3.1). Second, the systemic perspective provided by information studies is also beneficial for our attempt to classify the variety of publishing environments (blog, repository, journal, database etc.) currently available on the Internet (see 3.3.2) and to describe the specificity of a scientific journal in relation to them. Finally, the field of

information studies associated with the field of computer sciences invite to approach multimodality also from the perspective of hyperconnectivity and, at last, raise the question of knowledge generation based on machine-to-machine communication – i.e. by purely technical means based on artificial intelligence that allow texts to "be assembled and reassembled without passing through human intention and intelligence" (Bazerman 2011:slide 2).

Library science and information science, often associated under the label library and information science, are not distinguished in the present study. As reported by Martínez-Arellano (2013), library science, library and information science, and librarianship, each of these fields in its own way addressing matters concerning knowledge transfer "to a certain extend can be considered interchangeable" (Martínez-Arellano 2013). In that sense, they are included in the field of information studies, too.

In the following, in a first subsection, the scientific communication system is described as regards its three main pillars – "publicity, trustworthiness, and accessibility" (Kling 2004:594). These pillars are revisited and reinterpreted in the context of the online dissemination of scientific information (3.3.1). In a second subsection, the specificity of a scientific journal is showed in comparison to other current online publishing environments (3.3.2).

3.3.1. Publicity, Trustworthiness, Accessibility in the Digital Environment

According to Martínez-Arellano, information science is "concerned with the principles and practices of production, organization and distribution of information and the study of information from its generation to its use and transmission in a variety of ways" (Martínez-Arellano 2013:n.pag.). Mackenzie Owen, following Bates, mentions…

> … three 'big questions' that should be addressed by information science: [1] the physical question: the properties of recorded information and the laws governing its universe; [2] the social question: the ways in which people relate to, seek and use information; [3] the design question: how to achieve rapid and effective access to recorded information (Mackenzie Owen 2010b:13).

In our understanding, multimodal scientific publishing raises a number of issues related to each of these interrelated aspects: the physical question engages with the "material reality" (Unsworth 2006:58) of the disseminated multimedia artefact produced (see 2.2.2): is a scientific multimedia artefact a whole or is it a set of objects, each of them requiring, for instance, a digital object identifier? "Artifacts of scholarly communication, such as publications and e-mail messages, are objects that can be used as whole units, or disaggregated and reaggregated. They can be counted, mined, stored, retrieved, and preserved" (Borgman 2007:164).

The social question is linked to the "social reality" (Unsworth 2006:58) of the multimedia artefact (see 2.2.2): which kind of interaction is possible with this specific multimedia artefact? How can it be referred to? How shall it be appropriately quoted: as a textual content only as it is the case traditionally, as a process, as a product? Kallinikos et al. (2013) treat this issue in relation to webpages and mention new practices that cope with this ambivalence:

> Given the nature of the Web, the Internet Archive has developed a range of new practices that seek to deal with the inherent fluidity of webpages by “freezing” content at a given time. This is done by taking snapshots of webpages that are automatically selected and harvested by a Web crawler (Kallinikos et al. 2013:361).

Is a snapshot of a scientific multimedia artefact a satisfying solution? The answer to this question depends on the third aspect or the design question taken up by Mackenzie Owen. The design question is associated with the "semiotic reality" (Unsworth 2006:58) of the scientific multimedia artefact (see 2.2.2): how can a scientific multimedia artefact remain accessible over time (a requirement of the scientific communication system) and which version of it, which state of interactivity with it? Given the "rapid obsolescence" of digital products, formats and the supporting software, this is a major issue for multimodal scientific publishing:

> When web pages are not regularly updated and attended to, after all, they’re subject to rapid degeneration: aging styles, outdated standards, and worst,

> perhaps, ‘link rot.’ Such ephemerality makes it arguable that the unspoken contract between the author and the reader of a piece of digital text is radically different from that between the author of a book and its reader; rather than assuming that the text is fixed, complete, and stable, the reader of a digital text may well assume otherwise (Fitzpatrick 2011b:11).

If information studies try to answer the question "who seeks what from whom, through what channel, and with what purpose" (Vickery 1997:459), the equation (digital multimodality + scientific publishing) to solve in this work, requires to address three kinds of issues, from a systemic point of view: the first kind of issues is a legacy of print technologies, the second kind is linked to digital technologies and the affordances of the web and the third kind results from multimodal approaches to scientific publishing.

As for the legacy of print technologies, the scientific communication system is based on requirements and standards defined by the "affordances of reading/writing on paper" (Taipale 2014:532) or printed documents. This is not astonishing after several hundred years of co-evolution of science and print technologies in comparison to which the emergence of digital technologies is short and recent. The most obvious affordance of the print document is stability and permanence (in comparison to the evanescent nature of memory), as well as solidity in comparison to the fluidity or liquidity (Casati et al. 2007) of a digital object. This stability is also linked to the established main pillars of the scientific communication system: awareness or "publicity", archiving or "accessibility", registration and certification or "trustworthiness":

> Publicity: The document has to be announced to scholars so that they may learn about its existence. ... Trustworthiness: The document has been subjected to a social process that assures readers that the content of the document satisfies the norms of quality accepted by the community. ... Accessibility: Readers must be able to access the document in a stable manner over time (Kling 2004:594).

All of these elements have been subject to intense and contradictory discussions at the time of the first electronic scientific journals ("Flora Online first appeared in January of 1987", Arlinghaus et al. 1993:4) and even before, at

the time of the first "interactive terminal[s]" (Herschman 1970). Around 45 articles published between 1970 and 2013, collected in relation to this work, contain the word "future" associated with "scientific publishing" or "scholarly publishing". They all express – directly or not, explicitly or not - statements in relation to publicity, trustworthiness and accessibility of scientific information. In the following a few of them are listed in chronological order:

Herschman	1970	The primary journal - past, present, and future
Senders	1976	The scientific journal of the future
Garfield	1980	Has scientific communication changed in 300 years?
Broad	1982	Hournals fearing the electronic future
Odlyzko	1995	Tragic loss or good riddance? The impending demise of traditional scholarly journals
Heller	1996	Publishing on the internet - a proposal for the future
Walker	1997	The electronic future of scientific journals - -
Smith	1999	Prolegomena to any future e-publishing model
Renear and Palmer	2009	Strategic reading, ontologies, and the future of scientific publishing
Willinsky	2003	The future of scholarly publishing
Byrnes et al	2013	The four pillars of scholarly publishing - the future and a foundation

The overall picture that emerges is a piecemeal approach that gave reason to Schaffner to conclude his paper dedicated to "the future of the scientific journals" publishing in 1994 as follows: "unless electronic journals can meet the most basic needs of researchers and readers that have been satisfied by print journals for almost 350 years, they will not be successful" (Schaffner 1994:246). Translated into terms of the present discussion, this means that issues of concern closely linked to print technologies – publicity (indexing service, citation), trustworthiness (peer review), and accessibility ("archivability", Arlinghaus and Zander 2008:n.pag.) – do not disappear with the digital mode of distribution on the one hand, and that they have to be regarded as essential dimensions by editorial initiatives based on a multimodal approach.

Issues of concern linked to the affordances of the web as regards scientific standards and requirements (publicity, trustworthiness and accessibility), have already been partially discussed when the characteristics of digital objects have been introduced (see 3.1.2): the main properties of digital objects – interactivity, distributedness, editability and openness – have been compared to the characteristics of the scientific article published online. In this respect, it has been noted that formal scientific publishing in academic journal tends to approach the affordances of the web as a threat rather than as an opportunity (Mackenzie Owen 2010): interactivity/connectivity is a threat with respect to potential copyright misuse (the awareness function or publicity), distributedness is a threat with respect to potential plagiarism (the registration function), editability is a threat with respect to potential obsolescence (archivability or accessibility, the archiving function), openness is a threat with respect to potential fake science (the certification function, prestige and reputation, or trustworthiness).

This obviously does not mean that alternative publishing models have not been suggested or implemented (see, among others, Willinsky 2000; Bachrach 2001; McKiernan 2003a, 2003b, 2003c; Whitworth and Friedman 2009a, 2009b; and Hendler 2007a, 2007b, 2007c). These alternative models consider logically the digital environment as an opportunity rather than as a threat and analyse how the three main pillars of the scientific communication system (publicity, trustworthiness and accessibility) can be adapted to web publishing and the digital environment. Two interrelated models have emerged from these discussions: the 'open access and rapid publication' model and the 'transparent review process' model.

Still in relation to the main pillars of the scientific communication system, a second series of issues linked to digital technologies and the affordances of the web has to be addressed in relation to another unique aspect of the digital environment. This series of issues is also related to issues derived from multimodal approaches to scientific publishing. The digital environment can be described as a conjunction of "three key technological systems – the Internet, multimedia, and hypertext" (Guay 1995.n.pag.). As a consequence of their

merger, it tends to closely interconnect three processes that were formerly clearly separate: writing (composing), publishing (evaluating and disseminating), reading (consuming). As a result, various types of scientific information (paper, conference paper, abstract, review, index etc.), all kind of data (raw data, multimedia data, metadata etc.) and documents (project documentation, report, transcript, workshop announcement, course description etc.), with various statuses (formal, informal; preprint, print and reprint; pre-peer reviewed, peer reviewed, and post-peer reviewed – see Stang et al. 2008), are currently available in a variety of publishing environments (blog, discussion forum, video repository, website, journal etc.), and this in a variety of formats (from blog post, video presentation, infographics to Prezi or PowerPoint presentation etc.). In a nutshell, the current situation is almost opposite to the "ideal online resource", once described by Harnad and Carr: "All research papers in all fields, systematically interconnected, effortlessly accessible and rationally navigable from any researcher's desk worldwide (Harnad and Carr 2000:630).

Already in 1997 Vickery pointed out that the "distribution [of information] in innumerable channels, both printed and electronic" (Vickery 1997:464) has to be understood as a cause and not as a consequence of "the fragmentation of knowledge [in parallel to] its increasing specialisation … The sum of knowledge on a topic is thus scattered among many messages of varying origin, in many channels, perhaps in many information stores" (Vickery 1997:464). More recently, in a blog post, Chang (2008), not without humour, makes an attempt to "[wade] through and [address] the confusion of scholarly communication semantics", relating especially to "the archiving of research works". After listing various denominations (archive, repository, library, search engine, database, data service, infoscience, research network, knowledge bank, open source platform), he concludes: "there is still plenty of semantical unclarity regarding the archiving of research works" (Chang 2008:n.pag.). Kenney et al. (2006) mention the same abundance as well as the same confusion and offer a list that include bibliographies, discussion forums, blogs, *What's New* and News Listings, online Journals and newsletters, web sites" (see Kenney et al 2006:68). A personal exploration of current publishing environments adds the following items to the above lists: blog, newsletter, bulletin, digest, search engine,

searchable databases, archive, database, digital library, channel, video sharing website, informational website, journal, forum, discussion list, middle-state publication as well as institutional, subject, or discipline-based repository (see Appendix 2).

As a consequence of such a multiplication of available options for disseminating different types of scientific information, common distinctions are less effective: the dividing lines between formal (a paper) and informal (a lab meeting) communication, internal and external communication, as well as between primary, secondary, and tertiary sources of information, but also the dividing lines between formal and grey (or gray) literature, are becoming more and more blurred. Pappas and Williams, in describing the current state of affairs regarding the difficulty to classify digital information, remind us the conventional status of non-written material – and thus the status of other semiotic resources other than written words – relegated so far to the archives:

> Rothstein and Hopewell propose that eventually grey literature will include non-written material, … "written media may no longer be the only archival source of scientific information. Consider, for example, the potential for podcasts or video clips of scientific reports as sources of data relevant to a synthesis". The proliferation of institutional Facebook pages, blogs, and wikis and the advent of Slideshare presentations suggest that this era may have arrived. Although the timeliness of grey literature is important, there are some disadvantages. A significant disadvantage is that it … "is not peer reviewed and not indexed in major bibliographic resources" (Pappas and Williams 2011:229).

It shall be clear now that traditional distinctions do not work properly in digital environments – with one notable exception perhaps, which is the difference between peer-reviewed and "not peer-reviewed" publications. The situation is becoming even more complex when new distinctions are promoted that have been specifically created for to do justice to digital objects stored in digital environments, such as dark, dim and light archive. This distinction is based on the criterion of accessibility, but is not always clear-cut either:

> A repository that preserves material for future use but does not provide current access is often referred to as a dark archive (Pearce-Moses 2005). … In reality, however, even the darkest of archives must permit some access by repository staff. The level of public access to the system can further distinguish dark archives. Some dark archives stress that they are dark because the system itself has no public interface and allows no public access … Other dark archives have public interfaces but allow no public access until a trigger event occurs. That trigger event could be negotiated with the content contributor …. People often refer to these archives as "dim," even "light," archives (Kenney et al. 2006:54)

Still in relation to the specific affordances of the digital mode of distribution, middle-range publications and middle-state publications take advantage of the fact that the three activities of composition, of dissemination and of consumption tend to be almost simultaneously performed online. Moreover these types of publication, often associated with visual materials, raise further issues concerning the popularization of science and the multiple publics of science (Stichweh 2003): who produces which kind of scientific information and how is it communicated to which target groups (practitioners, experts, children, students, general public)? Salter and Gann (2001) analyse "the role of middle range publications in the development of engineering knowledge" and define this category of publications in relation to visual materials:

> All forms of middle range publications are timely and user-oriented. Visual images are usually concentrated in commercial-oriented professional journals and corporate reports. Negative results also usually do not appear in academic articles, product catalogues, web sites and newspapers. … The core benefits of middle range publications are timeliness, user-orientation and visual images. All forms of middle range publications share these features (Salter and Gann 2001:24).

In an editorial posted in 2013 in an online periodical "occupy[ing] the niche between academic blogs and journals", Hawreliak defines middle-state publishing as "hybrid publishing [that] can provide the timeliness and succinctness of a blog, while retaining the rigor and context of a conventional journal article" (Hawreliak 2013:n.pag.).

To conclude this overview, a last issue of concern with respect to the three main pillars of the scientific communication system (trustworthiness, accessibility, and publicity) and to the advent of digital and multimodal scientific publishing can be mentioned. The need to define digital standards may be considered as a synthesis of all the previous issues discussed above. This aspect is particularly noticeable in life sciences:

> Every year, even every day, that passes without the biological information that is obtained and published by tens of thousands of laboratories worldwide being machine-readable is a lost opportunity and a costly affair. Essentially, if there are no digital standards on how information can be delivered, the information is not really accessible in the sea of published papers (Superti-Furga et al. 2008:1169).

Callahan et al., still in the domain of life sciences, describe how the digital abundance of information could undermine the foundations of the scientific communication system:

> With the advent of the World Wide Web, journals have increasingly augmented their peer-reviewed journal publications with downloadable experimental data. While the increase in data availability should be cause for celebration, the potential for biomedical discovery across all of these data is hampered by access restrictions, incompatible formats, lack of semantic annotation and poor connectivity between datasets (Callahan et al. 2013:200).

Borgman finally suggests that what is usually perceived as information overload or "data deluge" has to be viewed in relation to the current context and the lack of appropriate tools or procedures:

> Scientific data are the fastest-growing portion of the content layer. The data deluge has arrived, but the means to capture and curate it are in their infancy. We have only begun to understand how to emulate the legimitization, dissemination, and access and curation functions of the scholarly publishing system for data… (Borgman 2007:182).

In the context of this overview of the diversity of the fast-moving digital publishing landscape, how can the specificity of scientific journals be defined? Which functions do they currently serve? Which new functions could they serve? How are their traditional functions maintained or reinforced? And finally what role may multimodal publishing play in this context? These questions are answered in the following subsection, starting with the history of scientific journals and then exploring their present situation.

3.3.2. The Specificity of the Scientific Journal

Whereas the *Gesta Lynceorum* is recognised to be "the first proceedings published by the Italian Academia dei Lincei in 1609" (Willis and Bull 2000:n.pag.), "the beginnings of scientific journalism are generally placed in the year 1665, the year that saw the introduction of both the *Philosophical Transactions* and the *Journal des Sçavans*"(Kronick 1976:5). The scientific journal was born in the context of the scientific revolution (1450-1700) and in the context of the "outstanding new communication technologies [of that era – that is to say] "printing and the woodcut, engraving and etching (Vickery 2000:183). Schaffner underlines the roles played by the experimental method in the development of the first scientific journals:

> Gradually the practice of observation was refined, and the experimental method emerged. One of the purposes of the new scientific societies established in the seventeenth century was to sponsor public demonstrations of experiments. At the same time the practice of private correspondence among scientists in Europe served to communicate additional experimental results. The experimental approach called for a reporting of small, discrete units of information, rather than in-depth development of broad topics. This type of report was ideally suited to the format of the letter and later to that of the journal (Schaffner 1994:240).

The gradual establishment of the peer-review system – "antecedents of peer review practices go back to the 17th century (Kronick 1990:1321) – as an essential feature of scientific journals marks another milestone in scientific communication.

If the 17th century is generally considered as a turning point in relation to scientific communication, the 18th and 19th centuries can be viewed as the centuries of the development, refinement and consolidation of the refereed journal as it is known today. For instance, the tension between communicating and discussing new ideas (the journal as a forum) on the one hand, and recording and archiving scientific documents (the journal as an archive) on the other hand, is present since the beginning until nowadays (Zatz 2000:451). On this basis, it can be stated that the scientific journal "has been the mainstay of scholarly publishing for some 350 years" (Willinsky 2003:873).

A scientific journal is defined in relation to three "primary tenets: "IMRaD, peer review and editorial decision" (Linkov et al. 2006:596). To these three tenets, the International Standard Serial Number (ISSN) can also be viewed as an essential component allowing distinguishing between periodicals: "The presence of an ISSN lends an air of legitimacy to these publications and helps in weeding out more ephemeral publications such as newsletters and magazines" (Angrosh 2005:57).

The 20th century can be considered as a second turning point due to the advent of new communications technology, such as

> the cine film, radio and television, office duplicating, photocopying, offset lithography, microforms, photocomposition, facsimile, interactive computers, computer typesetting, word processors, desktop publication, telecommunication networks, satellites, electronic mail, magnetic and optical data storage, computer graphics (Vickery 2000:185).

In the context of this global evolution, the main motives for launching the first online journals in the late 1980s revolve around three issues: a) the rising cost of printed journals, publication delay of printed journals and "the fairness of blind reviewing practices" (Kling and Callahan 2003:127). Online publishing and electronic publishing have to be distinguished here in order to emphasise a specific momentum (occurring in the late 1980s and at the beginning of the 1990s) towards a more widespread adoption of the new digital mode of distribution. Lancaster (1995) points out that electronic publishing "can be

traced back to the early 1960s" (Lancaster 1995:518), but at that time journals were evidently not yet distributed online. When online journals were one the way of becoming the new norm over the 1990s, they were on features like easy access, rapid publication and transparent review process that can be understood as attempts of the scientific community to regain control over its research: "The academic community has lost control over its research output since the published results of its research are not disseminated directly by the universities but by journal publishers" (Lancaster 1995:524).

The "substantial advantages over paper books [offered] by publications in electronic form" (Lancaster 1989:324), if immediately perceived, the opportunity to disseminate "hypermedia publications" (Lancaster 1989:324), that is to say scientific multimedia artefact, do not appear to be among the main incentives leading to the adoption of the digital mode of communication. It is worthwhile coming back to the evolutionary model proposed by Lancaster in 1989. Already back then, he conceived as a sixth and "last" step in the "use of electronics" a move that is akin to multimodality as defined in the present study. Multimodality, indeed, allows presenting "information or inspiration in new ways, including movement and sound … with less reliance on text" (Lancaster 1989:318). In contrast, the first step for Lancaster

> is the use of electronic devices to generate publications through "computer typesetting" … The second and third stages of the evolution … refer to the distribution of publications in electronic form. In the second stage, publications are distributed in electronic form as well as in the form of print on paper. In the third stage, however, completely new publications emerge only in the electronic medium … (Lancaster 1989:317-319).

Lancaster's "attempt … to show the most important stages involved in the evolution of electronic publishing from the early 1960s to the present (and, indeed, into the future) (Lancaster 1989:316) has to be considered as farsighted, if not premonitory. The current situation of scientific publishing, 25 years after Lancaster's take, can best be described by a predominance of his third stage, whereas the sixth stage yet only concerns a handful of individuals and isolated

initiatives (see Chapter 4). Overall then, "in the sciences, and increasingly the social sciences [and the humanities], electronic publication has become the standard mode of scholarly communication. The humanities have been slow to follow, particularly art history and other disciplines traditionally dependent on sustained, linear argumentation (Ballon and Westermann 2006:10).

The specificity of the scientific journal can be explained in historical terms, as it is the most ancient medium disseminating validated scientific information. However, history alone does not explain why the scientific journal has not been totally replaced by some other channel of communication, among the countless channels that are available today and that are more efficient in terms of delay, cost and transparency. Taking an institutional view provides a second type of explanation: publishing in a peer-reviewed journal is a prerequisite for tenure and promotion in academia. In that respect, the article is "no longer intrinsically a means of distributing knowledge" (Steel 2006:175), but an administrative requirement.

The permanence of the scientific journal is even more surprising in view of the fact that its core mechanism – the review system – has been subject to considerable criticism: for instance Cawley (2011) asks, "Is peer review unethical?" Using a similar tone, Linkov et al. (2006) sceptically question, "Is there science behind peer review?" Despite this criticism, a recent survey (Mulligan et al. 2013) tends to confirm what Szklo already mentioned in 2006, "peer-review has been [and will stay] the bedrock of science, notwithstanding its flaws reflected by a less-than-perfect reliability and an unknown validity" (Szklo 2006:35).

The review system is therefore at the core of the specificity of the scientific communication system. Its pivotal status has been preserved throughout the shift from printed to electronic to online publishing. As Cronin (citing the Royal Society) put it in 1984:

> Consequently, rather than the scientific journal being the raison d'être of the peer review system, it is almost as if the roles have been reversed and the refereeing system has itself become the raison d'être of the primary publication process. Scientists may be less than totally satisfied with the scholarly journal as a

> dissemination mechanism, but they are deeply attached to it as a means of preserving a faithful and reliable account of scientific progress - as a repository of accepted ideas and beliefs (Cronin 1984:12).

Kriegeskorte (2012) introduces the notion of crystallization in order to further explain the specificity of the scientific journal in relation to peer review: "a scientific publication needs to be crystallized in the sense that it is a constant historical record that can be accessed permanently and therefore cited" (Kriegeskorte 2012:15-16). In doing so, he does not focus again on the archival function of a journal, but provides a model allowing distinguishing between different types of scientific communications ranging from informal conversation, discussion at lab a meeting, public discussion at a conference, scientific blog entry, conference presentation to peer-reviewed paper:

> Blogs are science's short-term memory. They enable more intuitive and divergent reasoning. The crystallized literature is science's long-term memory, which enables more analytical and convergent reasoning. Crystallized scientific publications include papers and reviews. Reviews are crystallized publications that serve mainly to evaluate one or several other crystallized publications. Crystallized publications are digitally authenticated documents that reference other scientific publications (Kriegeskorte 2012:17).

Using this model it becomes possible, first, to define a publishing environment as a tool for transforming crystallized publications into crystallized publications of a higher degree. Second, it becomes possible to characterize the specificity of a scientific journal in comparison to other publishing environments.

Before describing the specific process of crystallization associated with a scientific journal as the transformation a processed data into validated data, it is necessary to distinguish between data, knowledge and information. According to Liew (2007), data are…

> … recorded (captured and stored) symbols and signal readings. Symbols include words (text and/or verbal), numbers, diagrams, and images (still and/or video), which are the building blocks of communication. Signals include sensor and/or

> sensory readings of light, sound, smell, taste, and touch. As symbols, 'Data' is the storage of intrinsic meaning, a mere representation. The main purpose of data is to record activities or situations, to attempt to capture the true picture or real event (Liew 2007:n.pag.).

In comparison to data, "information is at its essence a message that is generated from activities and situations. Information resides in storage media (database, print, video tapes, etc.) in the form of data, or in the human mind as knowledge (Liew 2007:n.pag.). Liew illustrates then the relation between knowledge, data and information taking the book as an example: "A book is knowledge from the author's perspective, information for the potential reader, and data as well which is contained in a storage media (called 'book')" (Liew 2007:n.pag.). In accordance with these definitions, four main degrees of crystallization of data can be described and represented along a theoretical continuum:

1) From raw data to empirical or experimental data: the raw data or behavioural data are data produced for instance by individuals acting in the field. Those data are recorded by means of different technologies (a camera, a pencil, an audio-recorder, etc.). The result is a first type of crystallization. If the notion of raw data has been criticised (Boelstorff 2013), they can be defined as an ideal state characterising data 'extracted' from the phenomenological world that are left untouched. In general, a scientific endeavour is an attempt to stay as close as possible to this ideal state of the data.

2) From empirical data to "processed data or 'reconstructed picture'" (Liew 2007:n.pag.): the empirical or experimental data are analysed, interpreted and transformed into what can be defined as processed data. Experimental data (datasets) as well as processed data (the research documentation for instance) are more and more deposited and stored in an institutional repository. They are also included sometimes in journals as supplementary material.

3) From processed data to validated data: data, during this third phase, are validated by peers through a process of crystallization that can be seen as a social event: publishing a scientific article in a refereed journal. The scientific conference can be considered as an intermediary step between processed and validated data. The preprint or e-print archive is a publishing environment that

can also be understood as intermediary between the 'processed' and 'validated' state of crystallization.

4) From validated data to metadata. During this phase, the validated data disseminated as a scientific article are indexed for instance in a bibliographic database. In our view, a list of titles generated via a searchable database can be seen as specific 'reconstructed picture': the validated data are processed and digested, crystallized in a very condensed form. Metadata are also important for the key operation of citation: "The scientific publishing system is today a global interconnected information system, where the central glue is provided by the citations" (Björk 2004:n.pag.).

This cycle can obviously be even more complex – "data about metadata could be termed 'metametadata'", as Boellstorff (2013:n.pag.) suggests – nevertheless, the presented steps are sufficient to cover the entire research process. From this point of view, a scientific journal as a publishing environment is eventually defined as a tool transforming processed data into validated data (a scientific article) through a process of crystallization including the peer-review process and the production process. In comparison, a blog can be understood as a personal tool allowing the transformation of experimental or empirical data into processed data that can be further validated through another process of crystallization. For instance, Kriegeskorte first published a version of the article previously cited as a blog post (see Kriegeskorte 2009). In such a case the blog post is close to "an informal discussion between two people" (Kriegeskorte 2012:16). A blog can also be used as a secondary service reviewing validated data or primary publications and therefore be located close to the indexing service.

The potential benefits of this presentation in terms of data are the following. First, the differences between informal and formal communications, between primary, secondary and tertiary sources of information, between grey literature and published literature, and finally between dark and light archives are now reinterpreted as various degrees of crystallization occurring during the research process and the knowledge generation cycle (see 4.1). Second, the process of crystallization does not distinguish a priori between semiotic resources. In

contrast to the aforementioned conventional distinctions often based on the primacy of writing (associated with formal communication, for instance), data are made of various semiotic resources. Thus the process of crystallization and the process of resemiotization (see 2.3) can be associated with the research process conceived as a whole. In that case, the connection between the empirical phase and the dissemination phase of the research process is also potentially reconsidered:

> As Dicks et al. (2006) suggest, meanings are produced through the inter-relationships between and among multi-media data sets. Inevitably, at the stage of research reporting, the often highly visual, aural and kinaesthetic nature of multimodal data leads to dilemmas of data representation and the search for a broader range of approaches to disseminating research findings that can accommodate multimodal data (Flewitt 2011:295).

Another potential benefit related to the above is that data and publications are no longer disconnected:

> Scholarly publications tell the story of data, regardless of whether those data are biological specimens, ecological sensor data answers to interview questions, potshards found in an archaeological site, or themes in fourteenth-century manuscripts. The story may be lost when the data and the publications are separated. Making better links between data and the documents that describe them is a common need across disciplines … Scholarly products are useful to scholars in related fields and sometimes to scholars in distant fields. As the boundaries between disciplines become more porous, the interoperability of information systems and services becomes indispensable (Borgman 2007:225-226).

Finally, a last benefit linked to the data cycle is that a publishing environment can be seen as a platform dedicated to "innovative knowledge communities [that] advance knowledge by engaging in trialogical knowledge work [that is] – collaboratively developing shared "mediated objects" and "mediated artefacts" (Markauskaite 2010:91). More than an archive (monological) or a forum (dialogical), a scientific journal is therefore understood as a "multipurpose e-

Infrastructure" (Borgman 2007:252), or as a "new digital epistemic infrastructure that consist[s] of digital resources, software and conceptual tools and social structures" (Markauskaite 2010:81) – that is a combination of a repository, a blog, a searchable database, a content aggregator, etc.

How and to which extent do some of these benefits meet the needs of the scientific community remains to be assessed and analysed. However, it can be concluded, from the previous discussion, that even though the scientific journal as a publishing environment for disseminating research findings as well as a provider of scientific information is challenged by new types of digital publishing environments, it is still widely considered as the main venue for publishing research output. Its association with peer-review mechanisms ensures its continuity. Even if highly criticised, the peer-review process is still viewed as a main tool for quality insurance and certification.

How do existing multimodal scientific journals solve the equation discussed at length so far is investigated in the next empirical chapter.

4. Solving the Equation: The Multimodal Scientific Journal

Multimodal scientific publishing implies taking into account four interrelated dimensions approached in this work as two terms of an equation (digital multimodality + scientific publishing). The first term – digital multimodality – is intended to suggest a specific approach to online scientific publishing that takes advantage of web affordances and a wide range of semiotic resources beyond written words and static visuals to communicate meaning. The second term of the equation – scientific publishing – is a field of application of this specific approach. This field is based on standards and requirements (in terms of semiotic resources, formats and genres etc.) that result from a long history. The making of these standards and requirements is closely linked to the development of print technologies. This chapter is intended to analyse how existing digital, multimodal scientific journals adapt these standards to meet the opportunities, and the challenges as well, brought by the digital environment. In other words, it is intended to provide an empirical analysis of current multimodal approaches to scientific publishing as they are advocated and applied in existing scientific journals. To achieve this objective, it investigates how existing scientific journals solve the equation placed at the core of this work (digital multimodality + scientific publishing). In other words, this chapter is intended

In a first section, the first two chapters of this work are revisited in light of the epistemological integrative model of knowledge development proposed by Edwards (2000, 2010) (4.1). The aim of this synthesis is to provide a compass for navigating the 'empirical terrain' explored in the following sections of this chapter. On this basis, therefore, in a second section, a content analysis of multimodal integration strategies implemented in 38 academic journals is conducted (4.2.). The third section of this chapter is derived from that first loop of analysis. A sample of four selected journals is taken from the previous sample. Using General Method Analysis (Ritchey 2011), the "total set of relationships contained" (Ritchey 2011:42) in multimodal scientific publishing view as a "problem complex" is investigated. This second loop of analysis is intended to

help understanding which kind of scientific multimedia artefacts are produced and how they are evaluated, disseminated and consumed in relation to the previously described multimodal integration strategies.

4.1. Conceptual Map for the Analysis of Multimodal and Multimedia Journals

This first section is aimed to reframe the two previous chapters of this work and to introduce the empirical analysis. The epistemological "integral cycle of knowledge" proposed by Edwards (2000:n.pag.) is a model that enables an overview of the processes at play in multimodal scientific publishing and described in chapter two and three, from a theoretical viewpoint. This overall picture is then revisited in light of concrete examples of existing multimodal approaches of scientific publishing in journals – that is to say in light of how contradictory issues and conflicting interests in the relations between digital multimodality and scientific publishing are solved in practice.

Scientific research can be seen as a specific process dedicated to producing new knowledge through different phases (Björk 2007:12). The number and the name of these phases differ from one author to another, and from one model to another. Mckenzie (1999) describes the "research cycle" (Mckenzie 1999:n.pag.) in two broad moments. The first one comprises questioning, planning, gathering, sorting and sifting, synthetizing and evaluating. The second one – reporting - "comes after several repetitions of the cycle create sufficient insight" (Mckenzie 1999:n.pag.). Hanacek (2011) distinguishes also between two moments: the first one covers "the conceptual phase, the phase of construction of the research design, the empiric phase, the analytic phase". The second one is labelled "the disseminative phase" (Hanacek 2011:n.pag.), without further detail. This view consisting in isolating a phase including the different steps of the research itself from the dissemination phase is widely acknowledged. Following this trend, Houser (2014), for instance, describes nine "steps in the research method", the last one being devoted to "report[ing] the data in public arena such as a professional journal or presentation" (Houser 2014:10). This situation, however, leads to distinguish between a research cycle and a scientific publishing cycle as

two separate series of activities poorly connected to one another, and not as successive processes of resemiotization (see 2.4.).

The publishing cycle is, in turn, divided into a number of steps. Following Casati et al. (2007), four broadly recognised phases are distinguished in the present work: a phase of composition/submission (an article is written and submitted to a journal), a phase of evaluation (an article is reviewed, revised and processed), a phase of dissemination (an article is indexed and published online) and a phase of consumption (an article is retrieved, read, and commented). The sequential nature of this model could be discussed. It shall suffice here to say that, in the case of online publishing, a scientific article can indeed be simultaneously posted on a website, evaluated by peers and commented by readers. Nevertheless, posting an article is not disseminating a peer-reviewed and indexed article. In the case of a transparent online review system, for instance, an article is discussed first before it is certified and indexed. The open discussion is then closed and the archived article will never be revised (no case of scientific journals allowing this was found in the context of this study). If an author integrates feedback, then a new article is written and the publishing cycle begins again.

Following Edwards (2000), it is possible to synthesize these different models and go further beyond this diversity thanks to an approach emphasising the continuity between the research and the publishing cycles. In other words, it is possible to summarise how "scientific knowledge is produced, disseminated, evaluated and consumed" (Casati et al. 2007:n.pag.) by highlighting the four basic "strands or processes of valid knowledge acquisition" (Edwards 2000:n.pag.) on which these models are based. More importantly, Edwards' integrative model allows us to understand how the choice of appropriate semiotic resources to communicate meaning (and not just the choice of appropriate words to express ideas) should be considered, in the digital era, as an essential part of the overall process of knowledge generation. In a nutshell, Edwards' integrative model gives us a framework that can be used to explore how the 'digital multimodality' term and the 'scientific publishing' term of the equation are concretely linked together in some scientific journals and thus to analyse some empirical solutions of the

equation (digital multimodality + scientific publishing) found in current scientific journals (see 4.3).

The first 'injunctive strand' is linked to the "disciplinary matrix" and methodologies - "do this, perform this behaviour" (Edwards 2000:Figure 1). This is the phase of the "construction of the research design" (Hanacek 2011:n.pag.). The second 'apprehensive strand' is about enacting specific methodologies, performing the research and collecting the data. The next strand, the 'interpretive strand', is analytical and conceptual. During this phase multimedia research materials (see 2.3.2) are produced, data previously transcribed or translated are interpreted. This sense-making phase is important for the present work, and multimodal approaches to scientific publishing in general, because it relies on "cultural worldviews and language" (Edwards 2000:Figure 1). More precisely,

> this process is an interpretive, reflective, assimilation phase that follows on from the empirical experience and the observation and gathering of the data. It cannot be reduced to any of the other three strands because its source is the scientist-practitioner's own explanatory and interpretive agenda that moulds and contextualises the experience/data to enable it to be expressed and publicly presented. The interpretive strand is the cultural means by which experience is mediated into some form of social or linguistic expression of that experience (Edwards 2000:n.pag.).

Understood in the context of the present work, this 'interpretive strand' implies various processes of resemiotization (see 2.3) and crystallization (see 4.1). "Linguistic" in the previous quote highlights the fact that language is classically understood as the dominant mode of expression that guides the whole phase of interpretation. The 'last' strand called 'validative strand' is about "communal verifications, peer group confirmations, evaluative criticisms, gathering feedback – [that is] present[ing] findings and publish[ing] paper" (Edwards 2000:n.pag.). This validative strand – the process of selection and inclusion of relevant information into a domain – applied to scientific publishing refers to the review process and the specificity of scientific journals in comparison, for instance, to a blog (a blog is more focused on the interpretive strand).

Regarding the previous description of the knowledge cycle, it is important to insist the fact that, once validated, the knowledge generated is preserved in some form in order to be reused (accessed and/or applied). As a consequence, the validative or evaluative strand is also linked to information preservation techniques (indexing and archiving certified materials) that are, in turn, linked to information retrieval techniques and therefore to the 'injunctive strand' and by ricochet, to the 'apprehensive' and 'interpretive' strands. From this perspective, it becomes also possible to understand the whole process of scientific knowledge generation, with its four basic phases, in relation to memory (or the memory of a specific domain) and different techniques of preservation and storage that evolve from a

> specific cognitive advancement … Early cognitive advancements include the ability to recall events and create symbolic representations through gestures, signs, and sounds. Later cognitive advancements, such as the ones that define theoretic culture, include the ability to produce written symbols and engage in paradigmatic thought. … In a theoretic culture, literacy skills consist of the ability to read and write alphabetic print texts … For hundreds of years, these skills were sufficient. However, Shaffer and Kaput (1999) argue that digital tools now allow for external processing to occur. Where pen and paper facilitate the external storage of memory, technology now enables us to readily compute algorithms, run statistical analyses, and create multimodal compositions. Consequently, Shaffer and Kaput (1999) posit that we are now in a fifth stage, that of virtual culture (Curwood 2012:233).

For the present research purpose, memory is understood as a 'background strand' that influences in part the other four strands of the "integral cycle of knowledge" (Edwards 2000:n.pag.). This 'background strand' refers to "the technologies of dissemination of meanings (the media), those of representation of meanings (the modes), and those of production of messages (print and paper; digitality and electronics)" (Pahl and Roswell 2006:ix). Placed at the crossroads of cognition, social interaction and technologies, this 'background strand' is also essential in order to understand how three publishing paradigms differ, do not entirely overlap and coexist in the digital environment – the print, digital and

multimodal publishing paradigms (see 5.1). A publishing paradigm is defined in this work as the glue that holds the methods of composition/submission, evaluation, dissemination and consumption of a scientific article together – that is "the set of elements that have to be modified for some association to be broken away or for some new one to be established" (Latour 1988:201). A specific publishing paradigm enacted in a specific publishing environment – a scientific journal, for instance – can be deduced from the analysis of the editorial policies and the published multimedia artefact of this specific publishing environment (see 3.3.1)

After describing the four strands of knowledge, Edwards (2000) relates them to "the formal components of scientific reporting" (Edwards 2000:n.pag.), i.e. the IMRaD structure of the scientific article genre (see 3.1.1). The validative strand is first paired with I (Introduction and literature review): "the current state of social knowledge in the field is explicated and analysed" (Edwards 2000:n.pag.). As discussed above, this formal component dedicated to reviewing existing literature and knowledge is associated in the present work with the 'background strand' of memory. As previously suggested, taking into account existing scientific knowledge in the digital era relies more and more on semantic indexing system, computing technologies and aggregator services. In contrast, the memory pertaining to print technologies relies on physical libraries providing access to publications. The state of the art included at the beginning of a monograph in this context can be understood as a technique for manually aggregating, filtering and introducing content to people who do not have direct and immediate access to the references listed.

The remaining formal components are associated as follows. The injunctive strand is paired with M (Method): "the essential procedural steps are described" (Edwards 2000:n.pag.). Here again, the 'background strand' should be kept in mind because technologies contribute indirectly to change the behavioural aspect too. The apprehensive strand is paired with R (Results): "the data and observations, test results are reported" (Edwards 2000:n.pag.). They are based on multimedia recordings and multimedia research materials (background strand). The interpretive strand is paired with D (Discussion): "the

interpretations of the results are presented" (Edwards 2000:n.pag.) – based possibly on multimodal formats (background strand). In order to complete the cycle, the validative strand is further associated with "Conclusion": "the impact of the new information on current knowledge is presented" (Edwards 2000:n.pag.). This formal component is usually included in the discussion (D) element of the IMRaD structure of the scientific research article.

The integrative model proposed by Edwards (2000) allows us to synthetize (see Table 2) the different elements analysed in the two previous chapters and to put into perspective 1) the research process and the knowledge cycle and 2) the process of resemiotization and the process of crystallisation. On this basis, in Table 2, under "activities and the research process", some elements of the two first levels of description of the research cycle (do research, communicate and apply the results) proposed by Björk (2007) and directly linked to formal publication in scientific journals are taken into account. Some other activities belonging to other levels of description are mentioned for illustrative and clarification purposes. All of those activities, associated with a specific strand, are then distributed across different perspectives outlined in this work: the publishing cycle, the process of crystallization (see 3.3.2), the process of resemiotization (see 2.3.2), and finally the IMRaD structure of the scientific article genre (see 3.1.1).

This conceptual map shows how the various notions drawn from four sources (the fields on composition studies and social semiotics and the files of genre studies and information studies) are connected. This conceptual map is revisited in the next two subsections dedicated to exploring empirically multimodal and multimedia journals.

Places	Knowledge generation cycle (based on Edwards 2000, 2010)	Activities and the research process (based on Björk 2007)	Scientific publishing cycle (based on Casati et al. 2007)	Data and the process of crystallization (based on Kriegeskorte 2012)	Semiotic resources and the process of resemiotization (based on Iedema 2003)	The scientific article genre and the IMRaD structure
	The injunctive strand (experiential engagement)	Study existing scientific knowledge Collect data from existing repositories				Introduction and Literature review
The Field	The apprehensive strand (behavioural engagement)	Do experiments and make observations		Raw data Experimental data	Multimodality of the field Multimedia recordings	Method
The Lab	The interpretive strand (sense-making engagement)	Analyse and draw conclusions Write manuscript	Composition Submission	Processed data	Multimedia research materials	Results
The Screen	The validative strand (social engagement)	Publish as scholarly journal article Do Peer review Integrate metadata Index and preserve publication	Evaluation Dissemination	Validated data Metadata	Scientific multimedia artefact	Discussion Conclusion
	The injunctive strand (experiential engagement)	Find out about the publication Retrieve publication Apply the knowledge	Consumption			

Table 2: Exploratory Map for the Empirical Analysis of Multimodal Journals

4.2. Typology of Multimodal Integration Strategies in Scientific Journals

The first loop of analysis, reported in this section, is intended to identify scientific journals with multimedia content of some sort and to develop a descriptive typology of multimodal integration strategies implemented in current online scientific journals. In doing so, it becomes possible to look beyond preconceptions (such as scientific journals with multimedia content are now commonplace) and then to answer a series of simple and somehow overlooked questions: which semiotic resources are actually integrated in scientific journals, how, and in which sections of the website.

To achieve these goals, a content analysis (Krippendorff 2012) is conducted of the multimodal integration strategies implemented by 38 academic journals. In the following section, first a multimodal integration strategy is identified as a discourse directed towards readers and contributors in different introductory sections of the website of a journal, such as "about the journal", "editorial policy" and "author guidelines". Second, the multimodal integration strategy enacted by a journal is inferred from multimedia items displayed on the homepage of the website (a video, a slide show etc.), and/or in the last issue (if applicable) of the journal and/or in a specific multimedia section.

Before going further, the following quick reminders are intended to place this first loop of empirical research in the broader context of the study: a) scientific information is today disseminated in a variety of online publishing environments but the emphasis here is on scientific journals because of the essential role they continue to play in the scientific community. The scientific journal keeps its position as the main official channel for disseminating formal research findings. The now pervasive digital mode of distribution of scientific content did not change this situation (see Chapter 3). b) Even if every text, product or event is by definition multimodal (see Chapter 2), this theoretical statement should however not lead to the conclusion that every scientific journal is based on a multimodal approach to publishing.

Finally, it is important to note that, beyond written words and static visuals (including graphs, figures and other diagrams), the semiotic resources taken into consideration for analytical purposes will be limited, in this chapter, to the four

next broad categories: 1) video, 2) audio, 3) animation (or 3D objects) and 4) application (or software). These semiotic resources can be a component of a multimedia artefact or can be published as a standalone resource in a section of the website of a journal.

In the following, first, the procedure to select the first sample of representative journals is explained (4.2.1.). In a second subsection, a content analysis is conducted of this first sample and conclusions are drawn regarding different types of multimodal integration strategies implemented in journals (4.2.2).

4.2.1. Identifying Scientific Journals with Multimedia Content

The first loop of analysis, reported in this section, is intended to develop a descriptive typology of multimodal integration strategies implemented in online scientific journals providing multimedia content of some sort. The multimodal integration strategy of a journal can be operationalized either through the presence of a discourse, or through the site activity related to actually publishing semiotic resources, or both. A strategy can be fully effective – in this case, each published scientific article (or almost) will be a multimedia artefact composed of a variety of semiotic resources. A strategy can however also remain nothing but a discourse. In this last case, the resulting scientific research article that is published, for instance, will be a conventional article based mainly on written words.

To sum up, a multimodal integration strategy is defined, first, as a plan or a method aimed to achieve a certain goal – in this case, disseminating a scientific multimedia artefact made of semiotic resources beyond written words and static visuals. As a discourse, a strategy is most of the time outlined in the editorial policy of a journal or in the author guidelines intended for contributors. Second, a multimodal integration strategy is defined as an effective website activity: a) semiotic resources or multimedia artefacts are actually displayed in some pages or sections of a journal-website or b) scientific articles based on a multimodal format are disseminated on a more or less regular basis.

Goals and Guiding Questions

The main goals of this first exploratory phase of analysis are the following: 1) Identifying a sample of scientific journals disseminating multimedia artefacts or at least inviting contributors to submit articles based on a multimodal format; 2) Defining a comprehensive range of types of multimodal integration strategies implemented in scientific journals.

In order to reach these goals, four questions are answered: 1) which online scientific journals explicitly mention "multimedia content" in its website? 2) Which online scientific journals display semiotic resources beyond written text and static visuals, and 3) where do they display such resources (in an article or in a specific section)? 4) Is such material displayed occasionally, frequently or systematically?

Sources of Information and Sampling

The sources of information and the selection criteria used to generate a sample of relevant multimedia scientific journals are now introduced. Several main sources of information have been used to compile a sample of potentially relevant scientific journals. These sources of information are categorised in the following as "online search", "research literature" and "recommendations".

1) Online search: A first set of relevant journals appeared by using search engines on the basis of a handful of keywords such as "multimedia", "multimodal", "digital" and "electronic" on the one hand; "academic", "refereed", "scientific", "journal" on the other hand. These keywords have been used in combination or not: "multimedia journal", "multimodal academic journal", "scientific journal" + "multimedia". These keywords have also been used in four languages, English, French, Polish and Portuguese. A similar type of search has been carried out focusing more specifically on web portals such as *findit.lu* bringing information from different scientific sources. The primary aim was to find academic journals where "multimodal" or "multimodality" is included in the name.

It is important here to single out *NewJour* as a useful source of relevant information for the present study. Launched as early as 1993 as "an e-mail announcement list for new online journals and magazines", *NewJour* currently comprises "over 31,000 titles/publications, in 25 languages, from 140 countries, subjects ranging from Accounting to Zoology" (NJ About n.d.)

2) Research literature: Two types of specialised publications have been taken into account in the process of selecting appropriate journals: a) Case studies dedicated to one or two journals based on a new publishing approach that takes advantage of the affordances of the web. b) Quantitative studies that discuss specific features of digital scientific journals.

3) Recommendations: as a last source of information, all the suggestions or notifications of "interesting online journals" made by colleagues have also been taken into account.

In order to select actually relevant journals from this first sample, the following four selection criteria have been applied: 1) The journal is an online journal, 2) it can be identified by an ISSN [International Standard Serial Number] or online ISSN, 3) the submitted contributions to this journal are subject to a peer-review process, and 4) the journal that is active, i.e. it publishes new issues or new content regularly {daily, monthly, or yearly).

There are another two criteria that are not mutually exclusive. At least one of the two needs to apply, however, for a journal to be selected for further analysis: 5) The documentation on the website of the journal mentions that the journal is capable of processing a broader range of semiotic resources than usual (by featuring terms such as “multimedia content”, “web 2.0 tools”, “video articles”, etc.). 6) The journal provides multimedia of some sort that go beyond written text and still images in at least one section of its website.

It should be noted that some journals have undergone major change in the period in which the present research project was conducted (For instance, a new publishing platform has been implemented with new features). The different versions of the respective journal will be mentioned in this phase of the research process and for the next steps only the most recent version will be considered.

The sample of journals fulfilling the above criteria has been then submitted to a three-step data collection process. The first two steps have been performed at the 'journal level' (that is the publishing environment approached as a whole) and the last one at the 'article level' (that is the scientific multimedia artefact).

- Extracting relevant statements concerning the policy of the journal in relation to semiotic resources. Three specific sections have been more specifically scrutinised: "about the journal", "editorial policy" and "author guidelines". In some occasions, information extracted from the editorial published along with the first issue of a journal was taken into consideration. Similarly, other editorials and articles presenting the history and/or the future development of a journal have been used in some cases. They are quoted when the expected use of semiotic resources is clearly and explicitly outlined.
- Noting and listing all types of semiotic resources other than text blocks that are displayed on the website of a journal.
- At the 'article level', reviewing the last issue published – or the first issue freely accessible for users who have not paid (i.e. post "publishing embargo") or the 20 most recently published articles – and then identifying semiotic resources used ("video", "audio", "animation", "application").

Once collected, data have been coded according to different attributes from which the descriptive typology of multimodal integration strategies implemented in scientific journals is derived (see 4.2). The following five attributes of the selected journals have been coded:

1) Profile: the profile of the journal includes its name, acronym, subtitle, and ISSN. The profile is completed by the research field(s) or area(s) of study covered by the journal as it appears on the website. The four categories as displayed in the following table are based on Mackenzie Owen (2010):

Humanities	history, musicology, language and literature, other humanities
Social sciences	sociology, psychology, political science, economics, education, communication, other social sciences, law
Sciences	medicine, biology, physics, chemistry, mathematics, technology, other sciences

2) First and last (online) issue.

Year of the first issue (or the first online issue in case of an existing older journal)
Last online issue (or last publication in the case of immediate publication)

3) Policy (declared practices): any reference made in the documentation supplied by the journal (in particular in the sections "about the journal", "author guidelines", "editorial policy") is quoted.

4) Website activity ('journal level'). Two main locations of multimedia content are taken into consideration:

Homepage: some multimedia content (video, audio, animation, application) is displayed on the homepage of a journal.
Section: a specific section is devoted to some type of multimedia content.

5) Prevalence in publications ('article level'). The last issue of a journal has been checked (or the last 20 published articles in case of immediate publication), in order to assess the frequency of published scientific multimedia artefacts. Following Mackenzie Owen (2010), a supplementary precaution was taken: "however, if few multimedia were found, and it was the editorial policy to include multimedia, a larger number of articles were checked" (Mackenzie Owen 2010:137-138). The following scale was used to assess the frequency of effective activity at the 'article level'. These rate are indicative and should be considered as a rapid estimate:

None
Rare (one or two articles of the last issue)
More frequent
Systematic (more than 50% of the last issue)

4.2.2. Describing Multimodal Integration Strategies

Content is understood, in the remainder of the analysis, as any textual, aural and visual content (dynamic or not, interactive or not), i.e. all semiotic resources displayed on the website of an online journal. Krippendorff defines a content analysis as "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (Krippendorff 2012:24). The content analysis conducted here is intended to be explorative and give a first insight of the multimodal integration strategies implemented by current scientific journals. The attributes described in the previous section are aimed to provide the necessary information to determine if the research finding (the typology of multimodal strategies) is replicable.

Krippendorff explicitly extends the applicability of the method of content analysis to other than textual semiotic resources:

> The reference to text in the above definition is not intended to restrict content analysis to written material. The phrase “or other meaningful matter” is included in parentheses to indicate that in content analysis works of art, images, maps, sounds, signs, symbols, and even numerical records may be included as data—that is, they may be considered as texts—provided they speak to someone about phenomena outside of what can be sensed or observed (Krippendorff 2012:25).

As regards the attributes defined, the conducted content analysis is based on pre-defined categories (for instance multimedia content at the article or at the journal level). On this basis, the (textual) editorial policy of a journal is observed and interpreted at the phrase level defined as the unit of analysis. In other words, an '*a priori* coding' approach of data is used rather than an 'emergent coding' approach (Stemler 2001:n.pag.). Overall, the combination of the four elements 'First and last (online) issue', 'Website activity (journal level)', 'Policy' and 'Prevalence in publications (article level)' allows inferring the specific multimodal integration strategy enacted by a journal. As already mentioned, the multimodal integration strategy cannot be automatically deducted from the

editorial policy of a journal. The editorial policy needs to be put into perspective by the actually published multimedia content.

Exploratory Sample of Scientific Publishing Environments

The various sources of information used during an exploratory phase and mentioned above (see 4.2.1) allowed gathering a wide range of 160 publishing environments that disseminate information about new (multimodal) approaches to scientific publishing in the digital environment (in a multimodal way or not), and/or that are based on innovative editorial concepts (in terms of the review system for instance). Analysing the common features of and differences between all these different publishing environments in detail is not part of this study. It is nevertheless worth mentioning a few elements intended to describe, in a schematic manner, the current scientific publishing landscape in order to situate the publishing environment 'journal' within the framework of this big picture (for a more detailed overview of this 'exploratory sample', see Appendix 1).

As chapter 3 indicates, the conventional scientific journal as a provider of scientific information is challenged in many respects except, most probably, as a certification mechanism. The different publishing environments identified may be grouped in four categories: 'blog' (forum, discussion list, wiki etc.), 'repository' (archive, institutional repository, video-sharing library etc.), 'journal', and 'aggregator' (searchable database, digest, newsletter etc.). These categories are not rigid and static and are constantly recombined to produce new 'middle state' publishing environments: overlay journal, group blog, journal series, and peer-review service. In the following, the category 'aggregator' is singled out before proceeding to a presentation of the first sample of journals.

The abundance of scientific information, that is currently available and disseminated online, makes the category 'aggregator' a particularly important and transversal category of scientific publishing environments: for instance, a blog such as Research Blogging (see Table 3) can be considered as a 'qualitative' aggregator. The same can be said for a repository or a database such as IntAct (see Table 3). A number of secondary services have been set up that are dedicated to filter information or transform data into metadata or even meta-

metadata (see 3.3.2). In the following list, a few examples of aggregators are compiled. These services do not only add to the diversity of access routes to scientific information but they indirectly tend, at the same time, to question the roles and functions of a conventional journal in particular regards trustworthiness and reliability. In other words, they act as an intermediary between users and producers/editors as can be seen in the following particularly representative examples from the viewpoint of the promoted innovative editorial concept:

DH NOW	Since 2009, DHNow [Digital Humanities Now] has been refining processes of aggregation, discovery, curation, and review to open and extend conversations about the digital humanities research and practice … The Editors' Choice selections showcase long-form and thoughtful pieces about research, methods, theories, and pedagogy, as well as interpretations of the results of digitally-based research projects. The most promising Editors' Choice pieces are solicited for peer-review and formal publication in our quarterly Journal of Digital Humanities (DHN About n.d.).
Research Blogging	ResearchBlogging.org allows readers to easily find blog posts about serious peer-reviewed research, instead of just news reports and press releases (RB About n.d.).
IntAct	IntAct [as a common curation platform for 11 molecular interaction databases] provides a freely available, open source database system and analysis tools for molecular interaction data. All interactions are derived from literature curation or direct user submissions and are freely available. (INTACT n.d.).
Retraction Watch	So why write a blog on retractions? First, science takes justifiable pride in the fact that it is self-correcting — most of the time. Usually, that just means more or better data, not fraud or mistakes that would require a retraction. But when a retraction is necessary, how long does that self-correction take? ... Second, retractions are not often well-publicized. ... Third, they're often the clues to great stories about fraud or other malfeasance... How long do they wait before printing a retraction? (RW About n.d.).
F1000Prime	F1000 Prime is a revolutionary post-publication peer review service that comprehensively and systematically highlights and recommends the most interesting articles published in the biomedical sciences, based on the recommendations of a faculty of 5,000 of the world's leading scientists and clinical researchers (called "Faculty Members"), plus 5,000 associates who work with them (called "Associate Faculty Members") (F1000 About n.d.)
ThoughtMesh	ThoughtMesh is an unusual model for publishing and discovering scholarly papers online. It gives readers a tag-based navigation system that uses keywords to connect excerpts of essays published on different Web sites (TM About n.d.)

Table 3: Examples of Scientific Publishing Environments

The category 'Journal' extracted from the 160 collected different publishing environments (see Appendix 1 for an overview) has been coded and assessed on the basis of the aforementioned criteria – 'ISSN', 'still in activity', 'policy', 'peer-review process', 'documentation' and 'multimedia content' (see 4.2.1. under 'Sources of Information and Sampling'). A first sample of 38 relevant journals (see Appendix 2 and 3) was established as result that complies with the criteria that were set.

1) Before presenting this sample a series of choices made during the selection process have to be explained.

Despite extensive research, only three academic journals were found with an explicit reference to multimodality in their name. However, these journals were not included in the first sample: the *Journal on Multimodal User Interfaces* (JMUI) "focuses on multimodal interfaces developed with and emphasis on user-centric design" (JMUI n.d.) and invites to download PDF. The *Journal of Multimodal Communication Studies* (JMCS) has published so far (September 2014) only one issue: articles are only available in PDF format. Finally, the website of *Multimodal Communication* (MC) edited by Sigrid Norris and published by De Gruyter Mouton (licensed access for full text PDF) is a website first generation (an online presence introducing an initiative) with, strictly speaking, no free content access.

The *Video Journal of Semantic Data Management* (VJSDM) has released just one issue in 2012 and has no ISSN. For these reasons it could not be included in the first sample of selected journals. Nevertheless it is mentioned here due to its concept of a "video journal" which is "an innovative and multimedial way of publishing and sharing current research in the area of Semantic Data Management" (VJSDM n.d.).

An ISSN is not assigned to *In Media Res* (IMR), *The Journal of Undergraduate Multimedia Projects* (JUMP) and *Vectors* (no acronym). If they do not meet all the criteria for inclusion in the sample, they are however explicitly based on a multimodal approach to scientific publishing (IMR) and a multimodal publishing paradigm (*Vectors*) that cannot be overlooked in the context of the present work.

Consequently, *In Media Res* (IMR) and *Vectors* (no acronym) have been integrated in the sample of selected journals. On the contrary the *Journal of Undergraduate Multimedia Projects* (JUMP) was finally not included. Its last issue being published already two years ago, JUMP no longer appears to be active. JUMP "is an electronic journal dedicated to 1) providing an outlet for the excellent and exceedingly rhetorical digital/multimedia projects occurring in undergraduate courses around the globe, and 2) providing a pedagogical resource for teachers working with (or wanting to work with 'new media'" (JUMP n.d.).

SciVee (no acronym) is "a science video sharing website" and a specific service dedicated "to make science visible" by synchronising "a video … with a published scientific article" (SCIVEE n.d.). The result is a specific format called a "pubcast": "*SciVee* Pubcast is a synchronized video abstract that enables a viewer to see the presenter discuss a journal article and read the highlighted sections at the same time. It is a much more dynamic way to absorb and retain knowledge than a text-only abstract or plain video" (SCIVEE Brochure n.d.). *SciVee* as a (secondary) service offered to researchers and academic journals is not included in the selected sample of journals, because it is not a journal itself. It is mentioned, however, due to its specific multimodal approach to scientific publishing, which consists of promoting already published articles or scientific works by means of visualisation. In terms of its multimodal integration strategy *SciVee* could be likened to the "independent section" strategy described below.

The following nine journals used to publish articles with multimedia content on a regular basis. They have not been included in the sample because they are also no longer active.

Name	First and last issue
Journal of Computer-Mediated Communication (JCMC)	1995-2008
Music and Anthropology (M&A)	1996-2006
International Journal of Learning and Media (IJLM)	2009-2012
Ethnomusicology Online (EOL)	1995-2005
Journal of seventeenth-century Music (JSCM)	1995-2010
The Journal for MultiMedia History (JMMH)	1998-2000

Interactive Multimedia Electronic Journal of Computer-Enhanced Learning (IMEJ)	1999-2005
Journal of Technology in Counseling (JTC)	1999-2008
Acoustics Research Letters Online (ARLO)	2000-2005

It is nevertheless worth mentioning these journals, and this for two reasons: first, all of them, except *International Journal of Learning and Media* (IJLM), were launched at the end of the nineties – thus during the first wave of broader distribution of online scientific journals (see 3.3). This indicates that these early attempts of multimodal approach to scientific publishing were a development that emerged in parallel to online scientific publishing. Let us mention that the *Journal of Computer-Mediated Communication* (JCMC) is still active (2014), but its original publishing platform is no longer available. Second, even though these journals are not included in the sample, it can be retained that they already put multimodal publishing in practice in some respect and that they indicate some important features that "tak[e] advantage of the multimedia capabilities of the World Wide Web, that is use graphics, audio and/or video files" (M&A Submission n.d.).

The following features of these early and now defunct multimedia journals are noteworthy:

- Various semiotic resources are incorporated in order to make an argument and not for illustrative purposes only (see Figure 9). A balance has to be found. Indeed "multimodal, web-based format[s] … [are] innovative forms of expressing research" (JCMC Submission n.d.) and "audio and video examples should be essential to the article's argument" (JSCM Submission n.d.), but "authors should not submit superfluous video clips or other multimedia elements that do not augment the educational purpose that informs the article" (IMEJ About n.d.).

3.1 Structured Practice Environment

In the structured practice environment, the student's interactions with the tools and equipment have been designed by the instructional designer to teach a specific concept and allow the student to practice performing a specific task. The viewpoint of the 3-D structured practice environment has been specifically designed to support the concept being learned. The actions performed by the student are limited to support the concept being learned and the actions being practiced. The student cannot explore the situation freely -- this is the power added by the virtual practice environment once the student has mastered the skills taught in the structured practice environment. Figures 3 and 4 illustrate practice sessions in the 3-D structured practice environment. When taking measurements with the dial indicator, the student is taught to relate the round coupling face to a clock face. The student uses 12 o'clock as a reference point by zeroing the dial indicator and taking measurements at the 3, 6, and 9 o'clock positions.

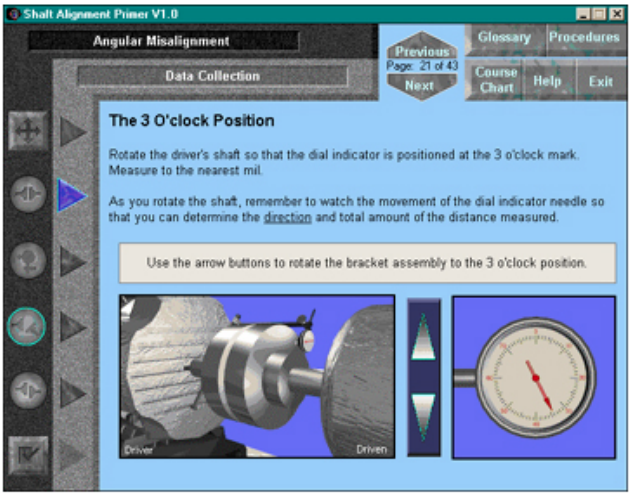


Figure 3. Structured 3-D Practice Environment.

File (1.39 MB)

inline demo (requires Authorware Web Player plugin)

In Figure 3, the student uses the interactive controls to rotate the animated dial indicator instrument from the 12 o'clock position to the 3 o'clock position to take the first reading. The student must watch the dial indicator face closely to

Figure 9: An Early Attempt (1999) of a Scientific Multimedia Artefact Incorporating Animation (IMEJ Article 1999)

- Multimodal publishing is associated with a global project, a reflexivity, an exploration (see Figure 10):

> The Journal for MultiMedia History (JMMH) … is the first peer-reviewed electronic journal that presents, evaluates, and disseminates multimedia historical scholarship … [*JMMH*] presents multimedia historical articles and explores how radio, television, CD-ROM/DVD technologies, World Wide Web (WWW) hypertext documents, Internet radio and video, and a variety of other multimedia

applications are transforming and expanding the possibilities for research, documentation, and dissemination of historical scholarship (JMMH About n.d.).

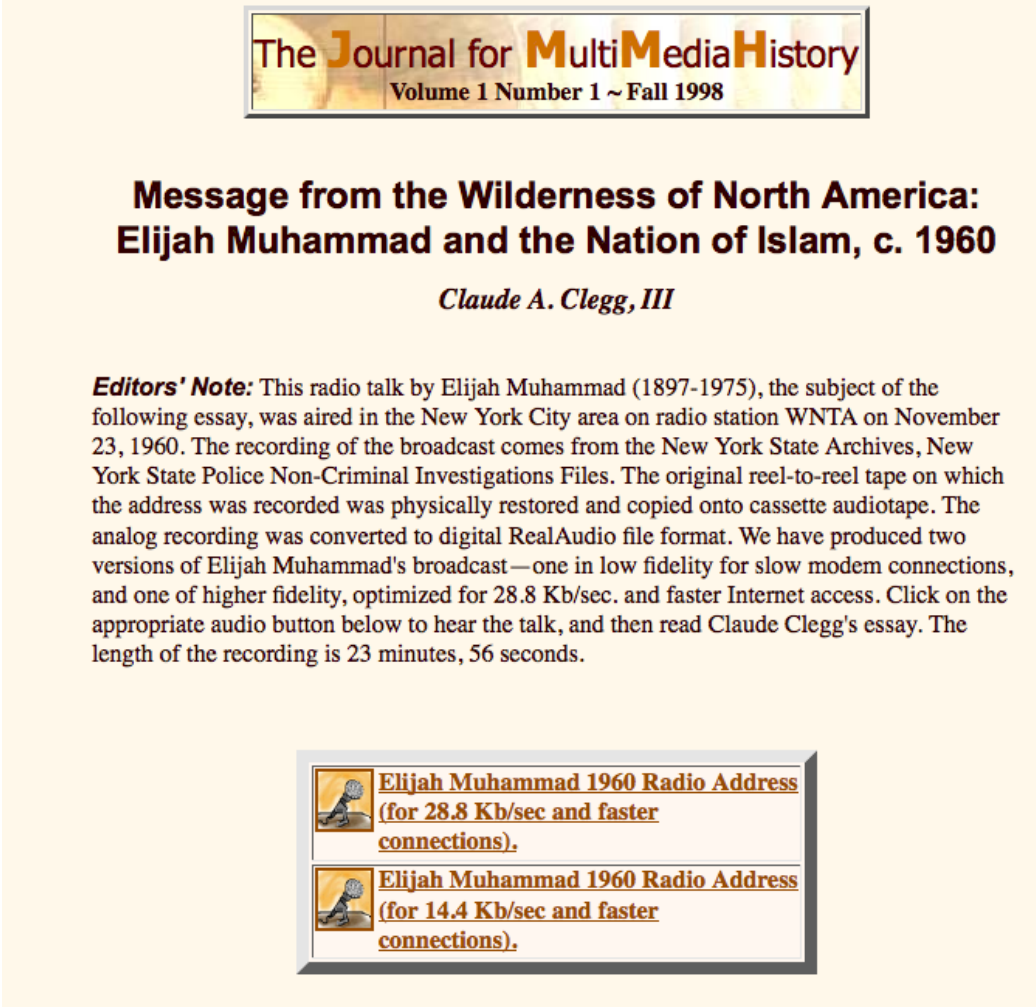
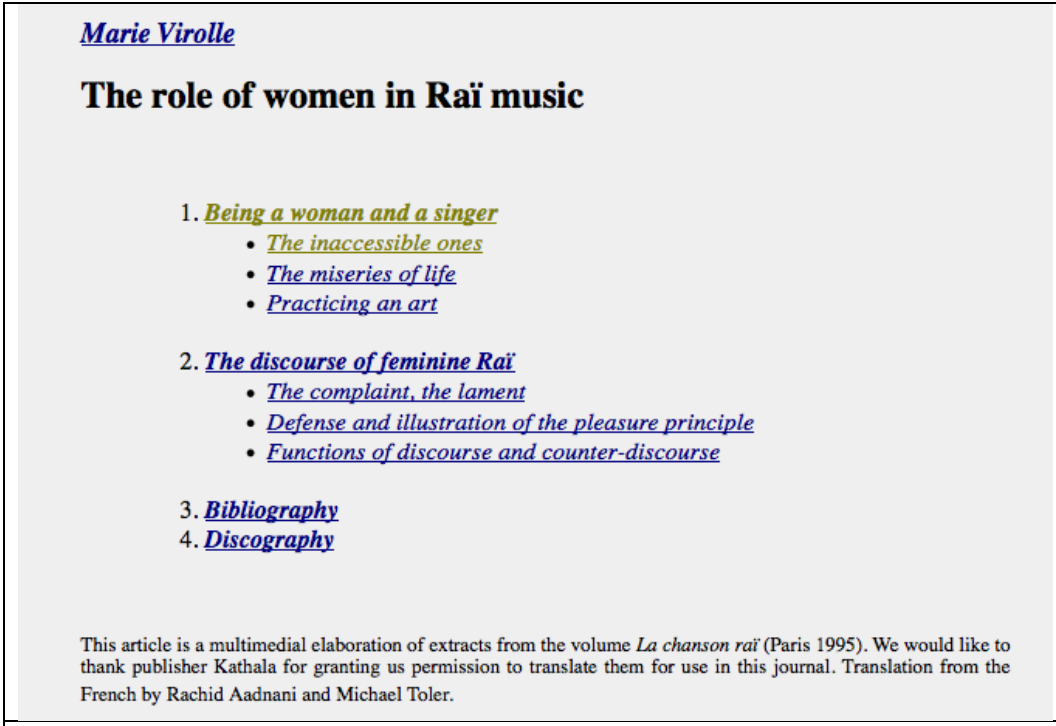


Figure 10: A Scientific Multimedia Artefact (1998) as an Audio-visual Project (JMMH Article 1998)

- The non-linear aspect (see Figure 11) of the format is another characteristic that has also been emphasised already at that point of time:

  A Web article may be conceived in many different ways, for instance as one text arranged in sections and illustrated with images, audio and video examples; or as non-sequential or multiply-branching texts dealing with different aspects of the chosen topic (M&A Submission n.d.).



Marie Virolle

The role of women in Raï music

1. *Being a woman and a singer*
   - *The inaccessible ones*
   - *The miseries of life*
   - *Practicing an art*
2. *The discourse of feminine Raï*
   - *The complaint, the lament*
   - *Defense and illustration of the pleasure principle*
   - *Functions of discourse and counter-discourse*
3. *Bibliography*
4. *Discography*

This article is a multimedial elaboration of extracts from the volume *La chanson raï* (Paris 1995). We would like to thank publisher Kathala for granting us permission to translate them for use in this journal. Translation from the French by Rachid Aadnani and Michael Toler.

Figure 11: A scientific article as a modular "multimedial elaboration" (M&A Article 1999)

- Finally the role of a "multimedia collaborator" is highlighted:

> The multimedia collaborator and author will schedule a period of approximately seven to ten days during which the authors will provide all multimedia materials necessary for the publication of the article. ... The multimedia collaborator will not alter the content of the paper, but will strive to increase its educational value as she/he integrates multimedia elements into the text (IMEJ About n.d.).

2) In the following, the journals that have been selected for further analysis (see Appendix 2 and 3) are introduced. In accordance with the presented approach, the selected sample of journals is explored in relation to declared practices (the use of semiotic resources in a contribution is mentioned in the editorial policy of a journal) or in relation to publishing activities actually observed on the website at the 'journal' and 'article' levels (effective dissemination of multimedia content and/or multimedia artefact). The following four categories have been devised as a result of the content analysis:

Policy only	No semiotic resource at the journal and the article levels in spite of a policy inviting submissions that make use of semiotic resources beyond text and 2D visuals.
Dedicated Section	Semiotic resources are displayed in specific section especially intended for this purpose
Rare and 2D	Semiotic resources are published, in the form mostly of static visuals, rarely as less conventional semiotic resources
Frequent or systematic	Multimedia artefacts are almost systematically disseminated in coherence with a specific editorial policy

The first category – 'Policy only' – includes 9 journals in which no recent publishing activity related to multimedia content could be detected, neither at the 'journal level' nor at the 'article level', and this despite an editorial policy mentioning the possibility of submitting such a content. Looking in more detail at the editorial policy advocated by these journals, semiotic resources beyond written words and static visuals are mentioned in the following ways:

- As "supplementary material": *Atmospheric Chemistry and Physics* (ACS), *Biogeosciences* (BG) and *The American Association of Pharmaceutical Scientists Journal* (AAPSJ). For instance, the *AAPS Journal* notes that "supplementary material ... can be accommodated and may contain highly interactive features or large databases" (AAPSJ About n.d.).
- As "multimedia files" (Journal of the *Acoustical Society of America Express Letters* – JASA-EL) or "dynamic and interactive components" (*Earth Interactions Journal* - EIJ). The following journals represent also this case: *Sociological Research Online* (SRO), *Philica* (no acronym), *The Contemporary Issues in Technology and Teacher Education Journal* (CITE), *Palaeontologia Electronica* (PE) and *Currents in Electronic Literacy* (CEL). Encouraging contributors to use less conventional semiotic resources is aimed to "free authors of the constraints of the static printed page in the presentation of their research results" (EIJ Question n.d.).
- Still in this category, after listing various semiotic resources, *Living Reviews in Relativity* (LRR) describes a specific reading experience associated with "a hypertext document":

> "With a hypertext document, a viewer navigates information by following links on an "as-needed" or an "as-desired" basis. Thus, the path one follows through a hypertext document can result in an individual experience: self-selected and thus self-directed. Given this dynamic quality of hypertext, we expect Living Reviews to be used rather than just read" (LRR About n.d.).

From the analysis of the editorial policy of the journals included in the first category, it can be noted that:

- The discourse directed towards authors can be described as impersonal and indirect: The "multimedia files submitted for JASA Express Letters (JASA-EL) will be reviewed…" (JASA-EL Submission n.d.). "Supplementary material, such as data sets, animated visualisation, etc., should be submitted together with the manuscript for peer-reviewed publication… (ACP Submission n.d.). "Articles may include…" (LRR Question n.d.). Other semiotic resources such as "pictures and tables — and even music, sounds, and animations — can be included as part of the text" (PHILICA Submission n.d.).
- In some cases, the discourse is turned to express an invitation and encouragement: "All authors are encouraged to take full advantage of the Web-only capabilities of online publishing, including 3-D, video, and interactive graphics…" (AAPSJ About n.d.). "Sociological Research Online encourages authors…" (SRO). "Authors will be encouraged to…" (PE Call n.d.).
- A mention found in the policy of EIJ reflects a move away from the primacy of text and a recognition of other than textual semiotic resources as fully equivalent to text but it means a change of perspective: "dynamic and interactive components … can only happen effectively if authors do not feel the need to also provide printable forms of this material in addition to the dynamic forms" (EIJ Question n.d.). In other words, this move implies a move away from printable versions of the journals as scientific multimedia artefacts can only be consumed on screen.

The second category of journals – 'Dedicated section' – concerns journals that are displaying multimedia content in a specific section especially intended for this purpose. This content does not seem to be fully recognised as semiotic resources for meaning making. 11 journals have been included in this category.

In most cases, this dedicated section is reserved to audio-visual semiotic resources, i.e. podcasts (REIP, BJ) or videos (FRONTIERS, TCR), or both (BMJ, EPAA, AIP). In rare cases, this dedicated 'multimedia section' is complemented by the integration of other multimedia content at the 'article level' (e.g. 3D objects). In some cases too, the homepage of the journal displays some multimedia content, such as a slideshow or a video presentation introducing the concept of the journal (e.g. *Frontiers*).

- The format and the purpose of this audio-visual material in a separate section do not differ significantly from one journal to the next. It is about presenting, discussing and promoting a recently published paper by means of a "5-minute audio or video podcast linked to an article that explains the main points" (EPAA Policies n.d.) or an "author video commentary" (FNS About n.d.). *Teachers College Record* (TCR) makes this material available on "a discussion platform" (see Figure 12) called *Vialogues* "which derives from 'video dialogues'" (VIALOGUE n.d.). By contrast, the 'multimedia section' associated with the *Electronic Journal of Geotechnical Engineering* (EJGE) is a "magazine" (EJGE Magazine n.d.) with "fun pages" (EJGE n.d.).

Education researcher Whitney Johnson discusses her co-authored Teachers College Record article, Teaching with Speeches: A Black Teacher Who Uses the Mathematics Classroom to Prepare Students for Life Watch and discuss this episode of The Voice on Vialogues.

Figure 12: The Voice: a Section Dedicated to Multimedia Content (TCR Section 2013)

- *Frontiers* and the *New England Journal of Medicine* (NEJM) are especially dynamic in relation to this complementary or additional audio-visual section. *Frontiers* creates visibility of a researcher in his/her field through video clips:

  > *Videos* is a platform which allows you to share pertinent videos instantaneously with your colleagues, groups, networks or entire community. Whether the recording of a lecture, discussion of a new research project or presentation of an award ceremony, Videos is an easy to use and simple method of communication which further establishes your presence in your field or specialty area" (FRONTIERS Community n.d.).

- Still in the same perspective (communication and promotion), but also in order to provide visual evidence, the *New England Journal of Medicine* offers a section called "Articles and Multimedia" (NEJM n.d.) sharing videos and images "in clinical medicine", "interactive medical cases" and "weekly audio summaries" of last publications. NEJM also displays multimedia at the 'article level', such as "audio interviews" (see Figure 13), "video roundtables" or "slideshows" (NEJM Perspective n.d.). These resources are associated with a type of scientific article called "Perspective".

Figure 13: Audio Interview Associated with an Article (NEJM Audio 2014)

- Finally, it is worth mentioning that the *Journal of Cell Science* (JCS) dedicates a specific section to the 2D poster format. A poster is downloadable as "Data supplement" (see Figure 14):

> CS@G posters are commissioned by the in-house Editors and undergo peer review. They are short primers that act as an introduction to, or summarise current knowledge of, an area of cell biology. CS@G posters feature a single detailed figure and accompanying text of no more than 3,000 words" (JCS Articles n.d.).

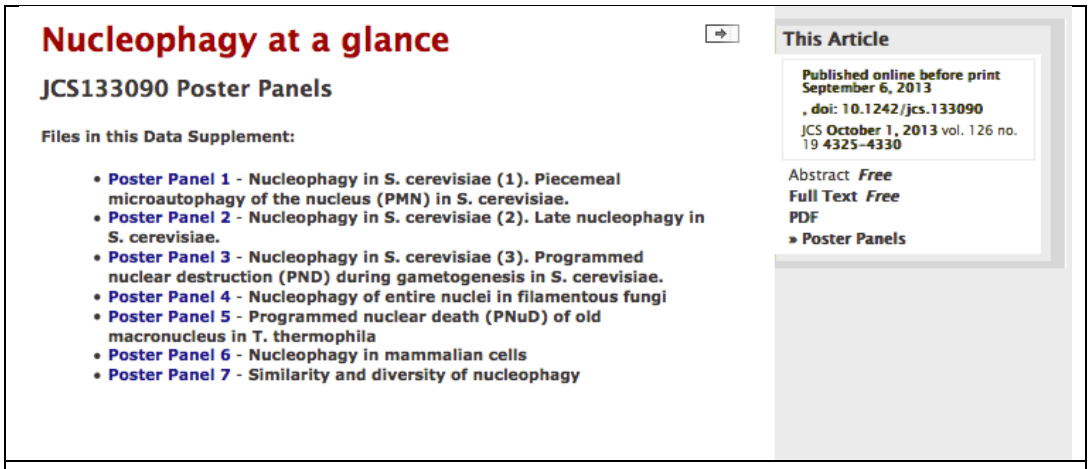


Figure 14: A 2D Poster Complemented an Article (JCS Poster 2013)

In the third category, 'Rare and 2D' (5 journals), some semiotic resources can be found at the 'article level'. However, resources that go beyond a much larger number of static visuals are sometimes difficult to find - hence, the label 'rare and 2D'. For instance, there is only a single video in the last issue of CITE, a single slideshow in the last issue of *Enculturation* (ENCULTUR), or a single Prezi presentation in the case of *Currents in Electronic Literacy* (CEL).

- In terms of policy, four of the five journals entering this category are based on what can be named an "acceptance policy", i.e. a policy indicating that submitting work with multimedia content of some sort is possible:

> *CITE* … allows authors to demonstrate the technologies about which they are writing, including video and audio segments, animation, virtual reality, Web links, and simulations (CITE n.d.).
>
> *Currents in Electronic Literacy* is a peer-reviewed journal that encourages submissions that take advantage of the hypertext and multimedia possibilities afforded by our World Wide Web publication format, as well as articles concerning the use of emergent electronic technologies. To this end, we gladly accept articles with graphics, sound, and hyperlinks submitted as HTML documents (CEL Submission n.d.).
>
> *Enculturation* … accept[s] academic work in all media forms suitable for web-based publication, including conventional articles, hypertexts, videos, and multimedia projects. (ENCULTUR About n.d.).
>
> "Internet Archaeology … publishes articles of a high academic standing which also try to utilise the potential of electronic publication. … When thinking about your article structure, remember to use the benefits of the web. Consider more than a linear text with supplementary images… (IA About n.d.).

The *New Journal of Physics* (NJA) mentions in a specific guideline to accept submissions supplemented by a video abstract (see Figure 15). Around 20 of these abstracts have been publishing over the last two years but this activity tends to be more and more frequent. This format is introduced by a textual tutorial ("how to make a good video abstract") providing technical and content-based recommendations ("raise your visibility", "what to film", "be creative" or "audio-visual quality [including] lighting … vibration … exposure … frame"…):

> Video abstracts are a brand new content stream for New Journal of Physics, aimed at increasing yet further the visibility of our authors and their work. Through this video media authors can now go beyond the constraints of the written article to convey their research, and provide a new, enhanced user experience for the journal's global audience" (NJP Abstract n.d.).

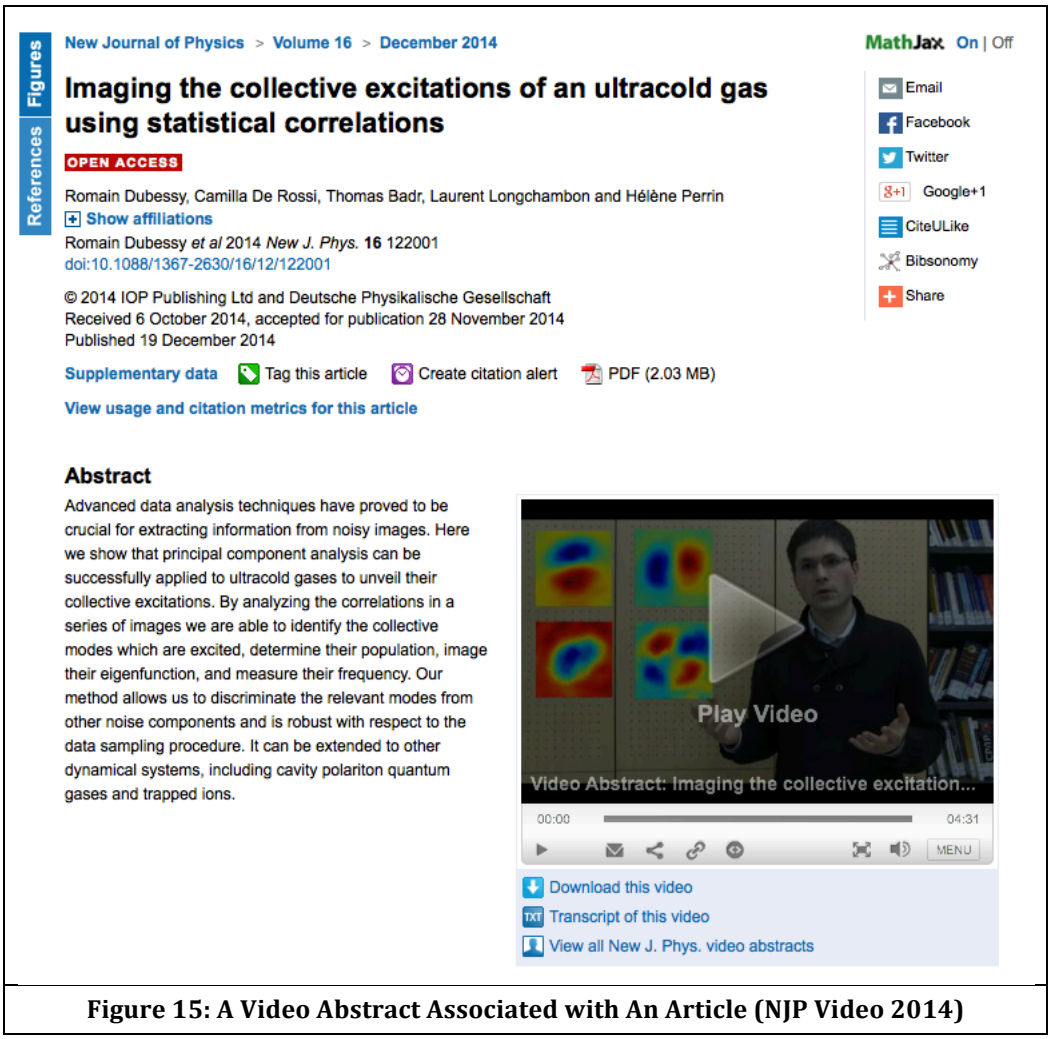


Figure 15: A Video Abstract Associated with An Article (NJP Video 2014)

The fourth category called 'Frequent or systematic' includes 9 journals whose editorial policy describes an explicit multimodal approach to scientific publishing and where multimedia artefacts are almost systematically disseminated regardless the topic treated in an article or an issue. In other words, disseminating a scientific multimedia artefact is an effective and not an accidental practice. The key characteristics of this category can be summarised as follows:

- First, the activity 'publishing a scientific multimedia artefact' is the main activity and the raison d'être of the journal. This means that the journal is not dedicated to publishing articles and *sometimes* multimedia artefacts). It is an activity that is coded and repeated and is based on "a norm shared by a group of people" Takahashi et al. 2010:7):

IPOL is a resarch journal of image processing and image analysis. Each article contains a text describing an algorithm and source code, with an online demonstration facility and an archive of online experiments (IPOL n.d.).

In Media Res is dedicated to experimenting with collaborative, multi-modal forms of online scholarship (IMR About n.d.).

Vectors is realized in multimedia, melding form and content to enact a second-order examination of the mediation of everyday life (VECTORS About n.d.).

Submissions for Computers and Composition Online need to be web-aware, meaning that they not only use the World Wide Web as a medium but also take advantage of the benefits of this kind of publishing (CCO Submission n.d.).

- Second, a specific multimodal format is often associated with the scientific artefacts published by a journal. An "exhibition" in the case of JAR (see Figure 16), a "webtext" (KAIROS), a video article (JoVE), an article with a Online Demonstration Facility (IPOL, see Figure 17)

JAR abandons the traditional journal article format and offers its contributors a dynamic online canvas where text can be woven together with image, audio and video. These research documents called 'expositions' provide a unique reading experience while fulfilling the expectations of scholarly dissemination (JAR n.d.).

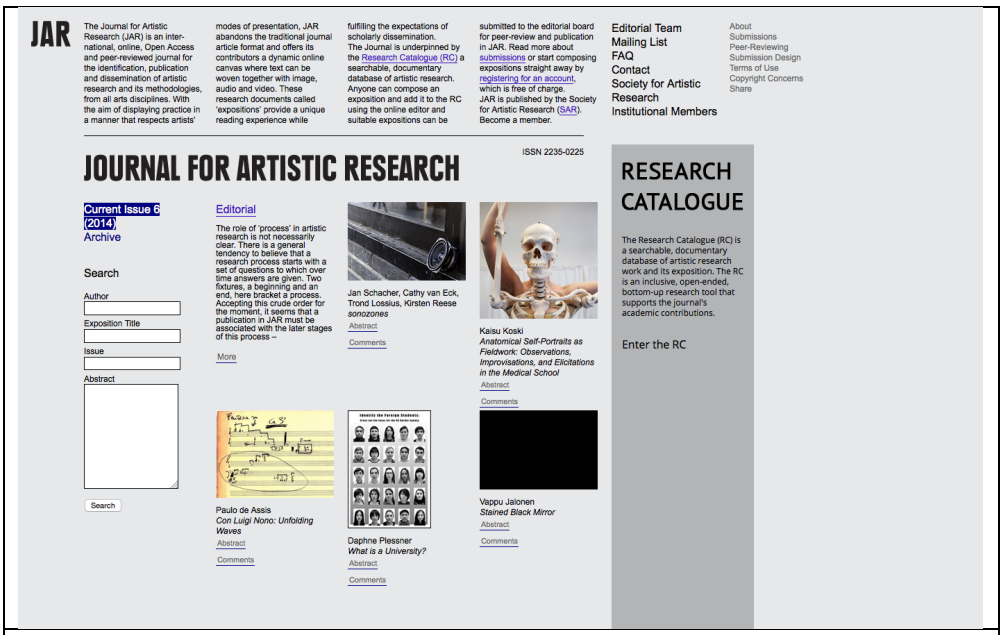


Figure 16: A series of Exhibitions Based on a Specific Multimodal Format (JAR Issue 2014)

"We publish "webtexts," which are texts authored specifically for publication on the World Wide Web" (KAIROS About n.d.).

"JoVE publishes peer-reviewed video-articles documenting techniques and protocols in biological, medical, chemical, and physical research" (JoVE Information n.d.)

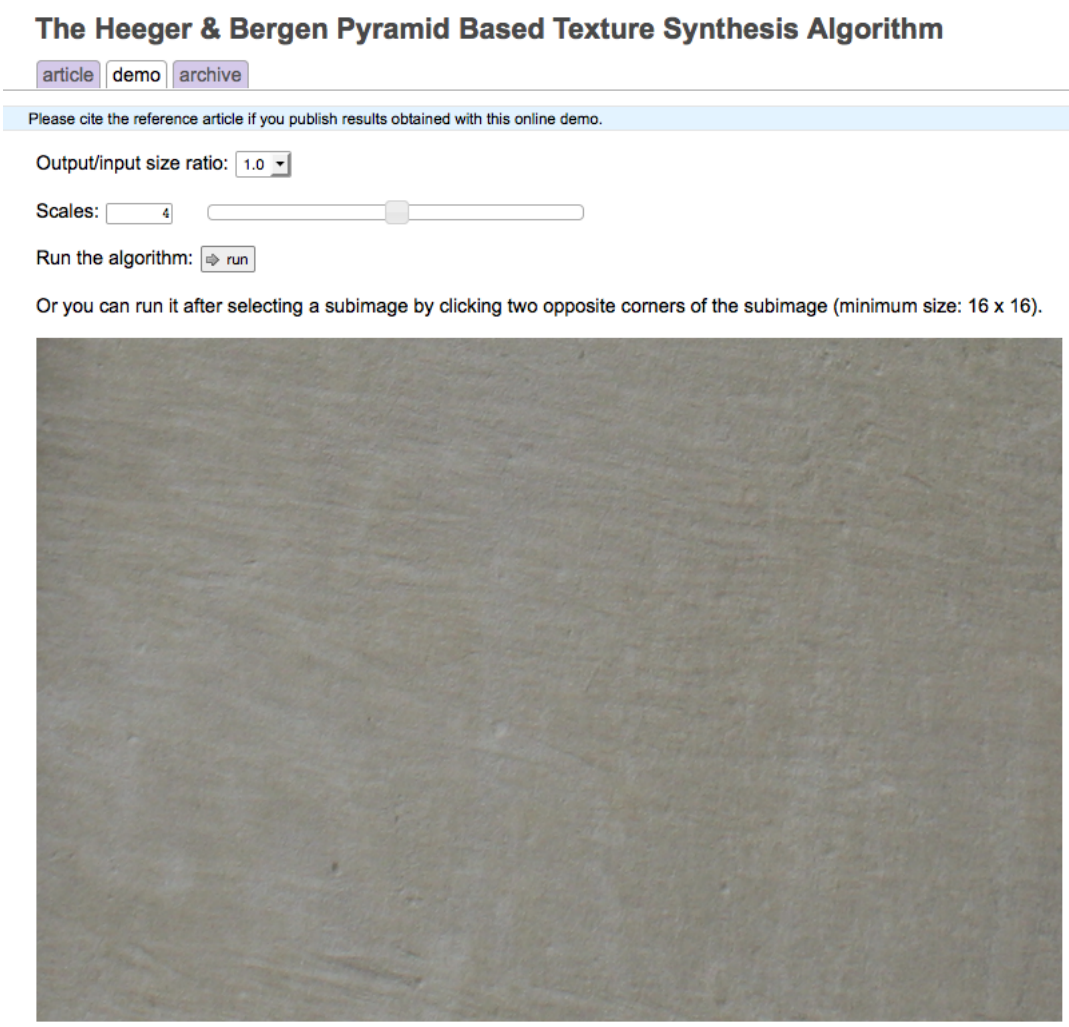


Figure 17: An Online Demonstration Facility Associated with A Published Article (*IPOL*)

- Third, a personal assistance or guidance is provided in order to help contributors in the process of multimodal composition:

  MTO Editorial Assistants and Consultants can provide assistance in some of these areas. Potential authors are welcome to contact the Editor to discuss their ideas (MTO Submission n.d.).

  Realizing that few scholars are experts in website design, we are eager to work with authors, photographers and videographers in the process of producing

image, sound, and video files for submissions. We are committed to assisting scholars at varying levels of technological proficiency (SSP Submission n.d.).

An editor can be assigned to help for the online demo part (IPOL Submission n.d.).

3) For the sake of completeness, the last four journals can be included under a label 'restricted access'. Indeed these journals could not be properly checked because they are based on journal-specific subscription fees:

- The *Journal of the American Musicological Society* (JAMS) associates a large number of published articles with the label "multimedia". This label can be viewed as the trademark of the JSTOR platform displaying the content published by JAMS. The only "multimedia article" freely accessible published in the last issue of JAMS includes audio-files. As regards multimodal publishing, the editorial policy mentions that with "volume 67 … the two most significant innovations are the new Digital and Multimedia Scholarship section (reviews and reports on scholarly work in these areas) and enhancements to the online version that include audio and video clips, color images etc." (JAMS Review n.d.).
- The *Journal of the Society of Architectural Historians* (JSAH) also uses the same clickable label "multimedia" associated with the JSTOR platform. In addition, on the website of this journal, three video tutorials are dedicated to specific multimodal formats. They are respectively named "how to prepare 3D models for *JSAH* online", "how to prepare videos for *JSAH* online" and "how to prepare panoramic photographs for *JSAH* online" (JSAH n.d.)
- The *Crystallography Journals Online* (CJO) is a series of eight journals: *Acta* A to F plus *Journal of Applied Crystallography* and *Journal of Synchrotron Radiation*. In the "sample issue" provided on the website (CJO Sample n.d.) for each of the eight journals, the readers are given the choice between different options to access the content of an article: HTML, PDF, CIF, 3D view, structure factors, or supplementary materials, etc. The 3D view especially is a specific format allowing manipulating and interacting with a 3D representation of a molecular structure. A specific reading tool called "highlight terms" can also be mentioned.

Category 'POLICY ONLY'	9
Atmospheric Chemistry and Physics (ACP)	
Biogeosciences (BG)	
Earth Interactions Journal (EIJ)	
Journal of the Acoustical Society of America Express Letters (JASA-EL)	
Living Reviews in Relativity (LRR)	
Palaeontologia Electronica (PE)	
Philica (PHILICA)	
Sociological Research Online (SRO)	
The AAPS Journal (AAPSJ)	
Category 'DEDICATED SECTION' (At the Journal Level)	**11**
AIP Advances (AIP)	
Biochemical Journal (BJ)	
Education Policy Analysis Archives (EPAA)	
Electronic Journal of Geotechnical Engineering (EJGE)	
Frontiers Journal Series (FRONTIERS)	
Journal of Cell Science (JCS)	
Revista de Enfermedades Infecciosas en Pediatría (REIP)	
Teachers College Record (TCR)	
The British Medical Journal (BMJ)	
The New England Journal of Medicine (NEJM)	
Fertility and Sterility	
Category 'RARE OR 2D' (At the Article Level)	**5**
Contemporary Issues in Technology and Teacher Education (CITE)	
Currents in Electronic Literacy (CEL)	
Enculturation (ENCULTUR)	
Internet Archaeology (IA)	
New Journal of Physics (NJP)	
Category 'FREQUENT OR SYSTEMATIC' (At the Article Level)	**9**
Computers and Composition Online (CCO)	
Image Processing On Line (IPOL)	
In Media Res (IMR)	
Journal for Artistic Research (JAR)	
Journal of Visualized Experiments (JoVE)	
Kairos (KAIROS)	
Music Theory Online (MTO)	
Southern Spaces (SSP)	
Vectors (VECTORS)	
Category 'RESTRICTED ACCESS'	**4**
Crystallography Journals Online (CJO)	
CrystEngComm (CEC)	
Journal of the American Musicological Society (JAMS)	
Journal of the Society of Architectural Historians (JSAH)	
TOTAL	**38**
Table 4: Overview of the First Sample (Journal vs. Published Multimedia Content	

- The rich HTML articles published by *CrystEngComm* (CEC) are not freely accessible. Dedicated to crystal engineering research, CEC "allows research to be presented in innovative ways. Authors are encouraged to use colour, movies and animated graphics" (CEC About n.d.).

Table 4 gives an overview of the 38 selected journals in relation to the aforementioned categories (for a complete summary table, see Appendix 2 and Appendix 3).

Typology of Multimodal Integration Strategies in Scientific Journals

The categorisation just outlined is interpreted now in terms of multimodal integration strategies implemented at the 'journal' and the 'article' levels (or both).

Figure 18: The 'Promotional' Integration Strategy (NEJM Audio Summary n.d.)

1) The first strategy ('Promotional') implemented at the journal level serves mostly promotional purposes. There is a specific section/space of the website dedicated to promoting recently published work (REIP) or to introducing a recent issue of a journal (NEJM) (see Figure 18). This space can alternatively also

be used for disseminating certain scientific content in a visual manner. In this case, this is a communication channel of scientific results used as a complement to the dominant channel through which original refereed articles are published (FRONTIERS). The content published in this audio-visual section is either uploaded by users or members of the community linked to a journal or they are produced by the journal editors in-house.

This integration strategy – 'Promotional' – is in general not observed in a journal in conjunction with an integration strategy deployed at the 'article' level (see below) even if this option is theoretically possible. A few exceptions to this pattern have been found: 1) Since June 2007 BJ has published 30 articles made available with supplementary materials labelled "3D structure", "Animation", and "Multimedia" (see BJ Structures n.d.). However, the most recent dates from July 2013. 2) NEJM regularly disseminates "Clinical cases", “Commentaries”, and the like, under the article category "Perspective" (NEJM Perspective n.d.). These contributions contain videos, audios and other semiotic resources – mainly as supplementary material. The article category 'original article' follows the same approach, but apparently with a lower frequency: two videos associated with four articles have been published within the last three months (Summer 2014). Overall, it appears that NEJM is a major exception in implementing multimodal integration strategies at both the journal and the article level. In the latter case, however, actual occurrences are "rare".

2) Multimodal integration strategies implemented at the article level are defined as regards the aforementioned categories 'Rare and 2D' and 'Frequent and Systematic'. Semiotic resources beyond written words and static visuals are, in the case, associated with or incorporated in the conventional scientific article. In order to better specify this family of strategies, the characteristic 'modularity versus linearity' can be used as an instrumental criterion. Modularity has been defined as a distinctive feature of a multimedia artefact (see 3.1.2.). Modularity (See Figure 19) means basically that the spatial organisation (and therefore the look) of a published article contrasts to the conventional printed page of words or to the linearity (verticality) of a text displayed on a webpage (see Figure 20).

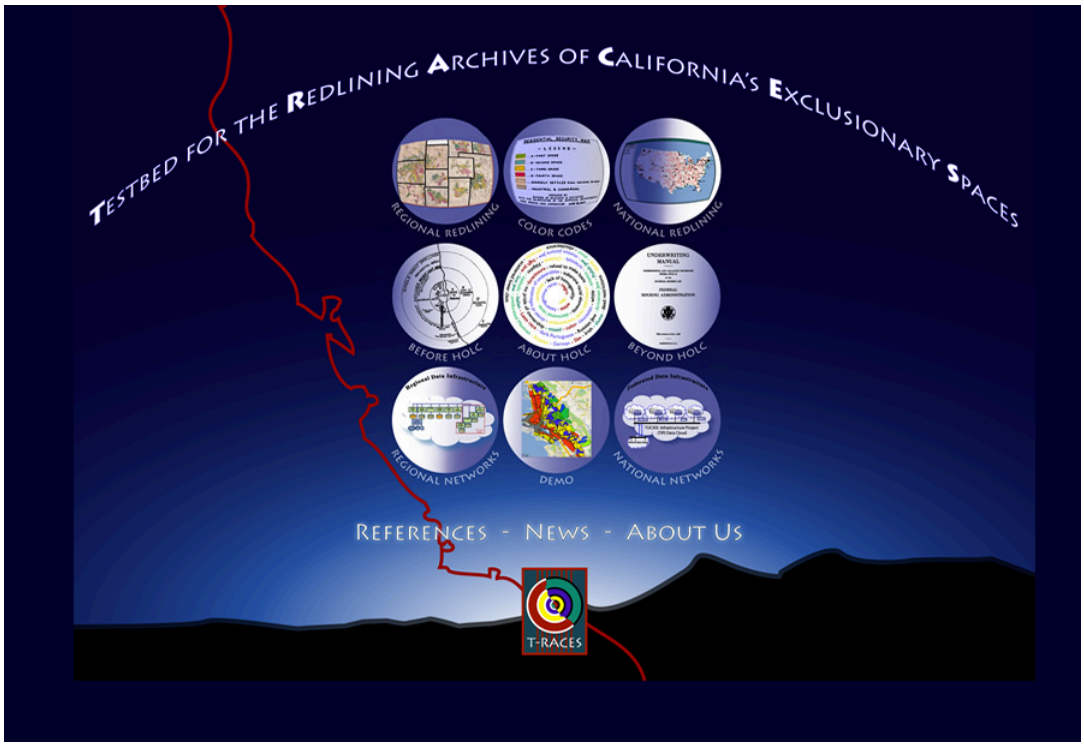
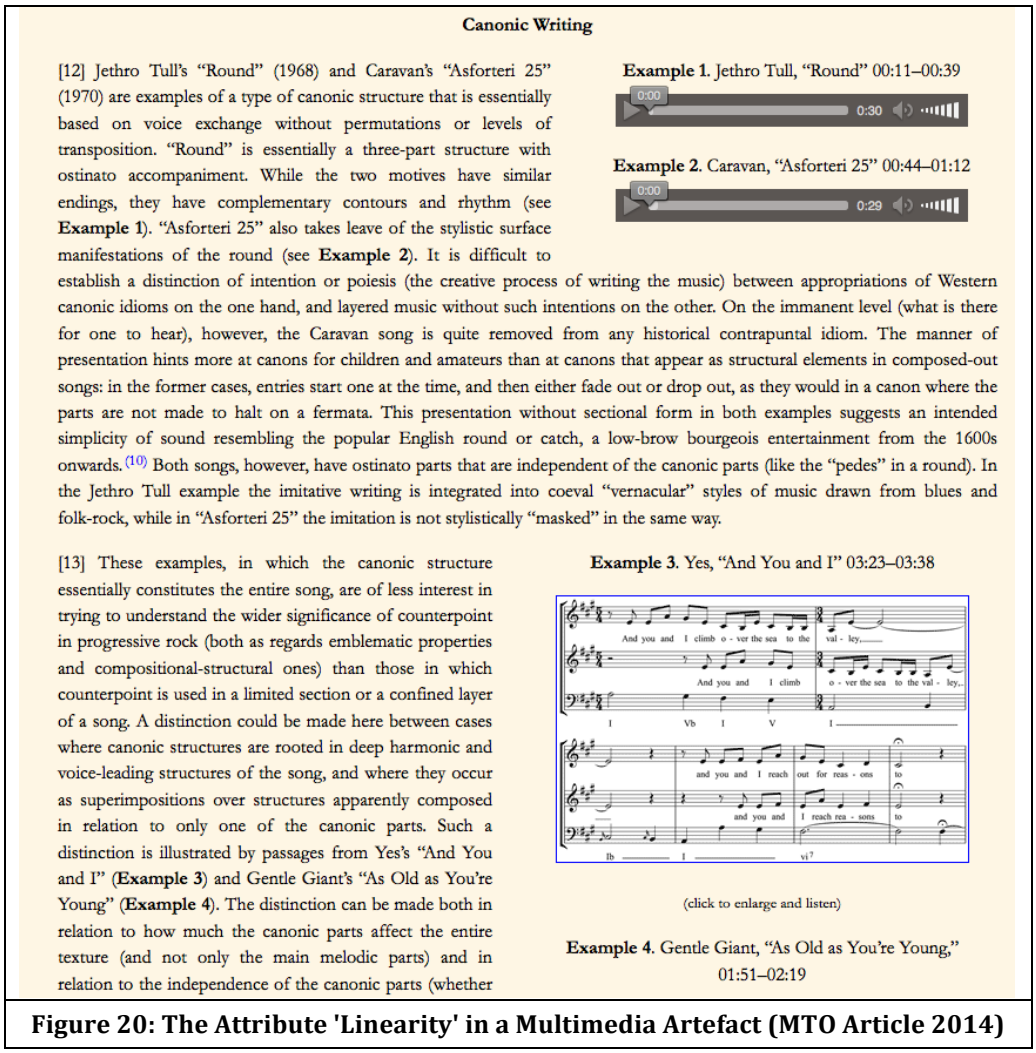


Figure 19: the Attribute 'Modularity' in a Multimedia Artefact (VECTORS Article 2011)

According to this meaning, an examination of the categories 'Rare and 2D' and 'Frequent and systematic' in conjunction brings up the following results: the characteristic 'modularity' is only associated with journals included in the category "frequent and systematic". More precisely, among the nine journals placed in this category – two (MTO and SSP) publish 'linear' articles and four disseminate 'modular' articles {CCO, JAR, Kairos and Vectors).

As for the three remaining journals (IPOL, JoVE, IMR), a third attribute needs to be placed in an intermediary position between 'linearity' and 'modularity'. This attribute – "bi-modularity" (see Figure 21) – is intended to describe a type of articles where the textual component and the visual component appear to be two autonomous semiotic resources associated for a specific purpose: in the case of JoVE, a video – that is a "visualized experiment" (JOVE n.d.) – is placed on the top of a "video article" and completes this article. IPOL associates a "text on an algorithm and its source code" to "an online demonstration … where the algorithm can be tested on data sets uploaded by the users" (IPOL n.d.).



Canonic Writing

[12] Jethro Tull's "Round" (1968) and Caravan's "Asforteri 25" (1970) are examples of a type of canonic structure that is essentially based on voice exchange without permutations or levels of transposition. "Round" is essentially a three-part structure with ostinato accompaniment. While the two motives have similar endings, they have complementary contours and rhythm (see **Example 1**). "Asforteri 25" also takes leave of the stylistic surface manifestations of the round (see **Example 2**). It is difficult to establish a distinction of intention or poiesis (the creative process of writing the music) between appropriations of Western canonic idioms on the one hand, and layered music without such intentions on the other. On the immanent level (what is there for one to hear), however, the Caravan song is quite removed from any historical contrapuntal idiom. The manner of presentation hints more at canons for children and amateurs than at canons that appear as structural elements in composed-out songs: in the former cases, entries start one at the time, and then either fade out or drop out, as they would in a canon where the parts are not made to halt on a fermata. This presentation without sectional form in both examples suggests an intended simplicity of sound resembling the popular English round or catch, a low-brow bourgeois entertainment from the 1600s onwards.(10) Both songs, however, have ostinato parts that are independent of the canonic parts (like the "pedes" in a round). In the Jethro Tull example the imitative writing is integrated into coeval "vernacular" styles of music drawn from blues and folk-rock, while in "Asforteri 25" the imitation is not stylistically "masked" in the same way.

Example 1. Jethro Tull, "Round" 00:11–00:39

0:00 0:30

Example 2. Caravan, "Asforteri 25" 00:44–01:12

0:00 0:29

[13] These examples, in which the canonic structure essentially constitutes the entire song, are of less interest in trying to understand the wider significance of counterpoint in progressive rock (both as regards emblematic properties and compositional-structural ones) than those in which counterpoint is used in a limited section or a confined layer of a song. A distinction could be made here between cases where canonic structures are rooted in deep harmonic and voice-leading structures of the song, and where they occur as superimpositions over structures apparently composed in relation to only one of the canonic parts. Such a distinction is illustrated by passages from Yes's "And You and I" (**Example 3**) and Gentle Giant's "As Old as You're Young" (**Example 4**). The distinction can be made both in relation to how much the canonic parts affect the entire texture (and not only the main melodic parts) and in relation to the independence of the canonic parts (whether

Example 3. Yes, "And You and I" 03:23–03:38

(click to enlarge and listen)

Example 4. Gentle Giant, "As Old as You're Young," 01:51–02:19

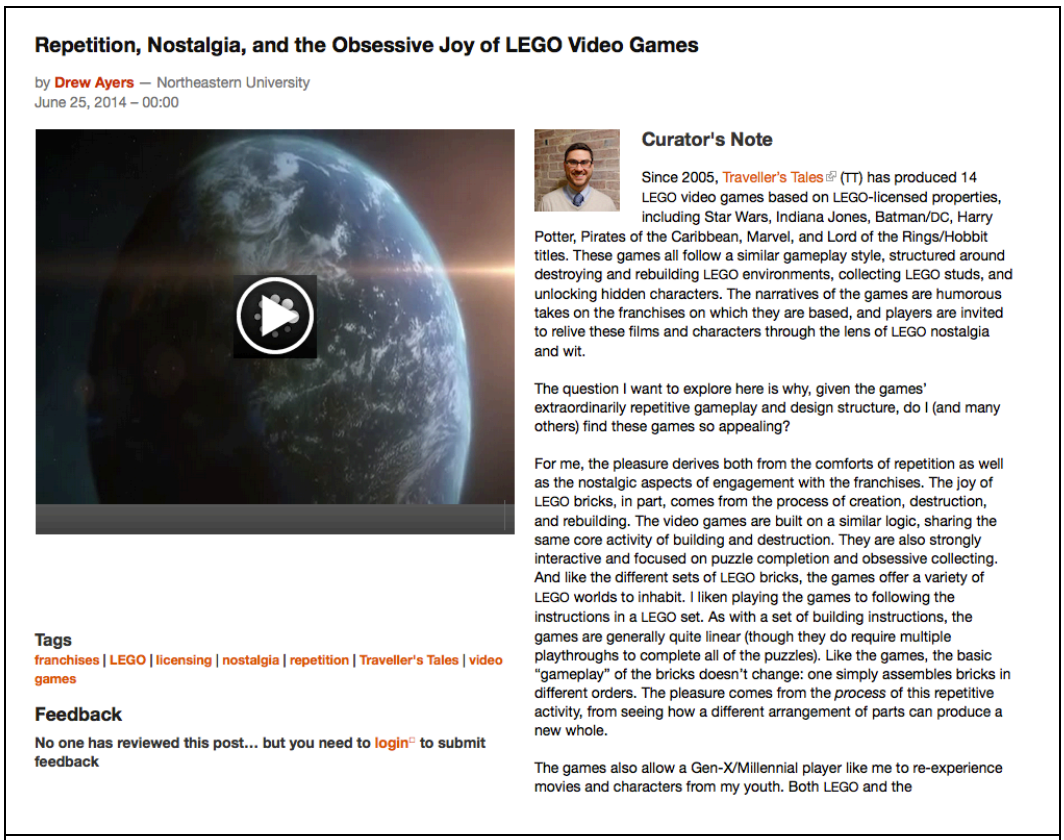
Figure 20: The Attribute 'Linearity' in a Multimedia Artefact (MTO Article 2014)

In *In Media Res*, the video (first semiotic resource) is analysed, commented and "curated" by means of written words (second semiotic resource):

> Like a curator in a museum, you are repurposing a media object that already exists and providing context through your commentary, which frames the object in a particular way. The clip/comment combination is intended both to introduce the curator's work to the larger community of scholars (as well as non-academics who frequent the site) and, hopefully, encourage feedback/discussion from that community (IMR About n.d.).

As for the five journals included in the category 'Rare and 2D', four journals (CITE, CEL, ENCULTUR, IA) disseminate mostly 'linear' articles with multimedia content incorporated in a text. The 'video abstract' connected sometimes to an article published on the NJP website can be understood in terms of the attribute

'bi-modularity'. For verification purposes, the criterion 'modularity versus linearity' has been applied to the articles published by journals included in the category 'Promotional'. No single case of modular or bi-modular articles has been found.



Repetition, Nostalgia, and the Obsessive Joy of LEGO Video Games

by **Drew Ayers** — Northeastern University
June 25, 2014 – 00:00

Curator's Note

Since 2005, Traveller's Tales (TT) has produced 14 LEGO video games based on LEGO-licensed properties, including Star Wars, Indiana Jones, Batman/DC, Harry Potter, Pirates of the Caribbean, Marvel, and Lord of the Rings/Hobbit titles. These games all follow a similar gameplay style, structured around destroying and rebuilding LEGO environments, collecting LEGO studs, and unlocking hidden characters. The narratives of the games are humorous takes on the franchises on which they are based, and players are invited to relive these films and characters through the lens of LEGO nostalgia and wit.

The question I want to explore here is why, given the games' extraordinarily repetitive gameplay and design structure, do I (and many others) find these games so appealing?

For me, the pleasure derives both from the comforts of repetition as well as the nostalgic aspects of engagement with the franchises. The joy of LEGO bricks, in part, comes from the process of creation, destruction, and rebuilding. The video games are built on a similar logic, sharing the same core activity of building and destruction. They are also strongly interactive and focused on puzzle completion and obsessive collecting. And like the different sets of LEGO bricks, the games offer a variety of LEGO worlds to inhabit. I liken playing the games to following the instructions in a LEGO set. As with a set of building instructions, the games are generally quite linear (though they do require multiple playthroughs to complete all of the puzzles). Like the games, the basic "gameplay" of the bricks doesn't change: one simply assembles bricks in different orders. The pleasure comes from the *process* of this repetitive activity, from seeing how a different arrangement of parts can produce a new whole.

The games also allow a Gen-X/Millennial player like me to re-experience movies and characters from my youth. Both LEGO and the

Tags
franchises | LEGO | licensing | nostalgia | repetition | Traveller's Tales | video games

Feedback
No one has reviewed this post... but you need to login to submit feedback

Figure 21: The Attribute 'Bi-modularity' in a Multimedia Artefact (IMR Article 2014)

To sum it all up, the characteristic "linearity" can be associated with an intra-modal integration strategy (see 4.2). In this case, *intra-* means a) that the textual component defines how the published multimedia artefact is navigated (from top to bottom), and thus b) that other semiotic resources are incorporated in the textual structure used as a frame (see Figure 19). By contrast, the 'modularity' characteristic is linked to a trans-modal integration strategy (see Figure 20). In that case, semiotic resources are conceived as tools for meaning making and for supporting a scientific argumentation. Finally, the characteristic 'bi-modularity' is representative of an inter-modal integration strategy, which is a strategy based on the interplay between two main types of semiotic resources. Each of the employed semiotic resources plays a precise role within the multimedia artefact

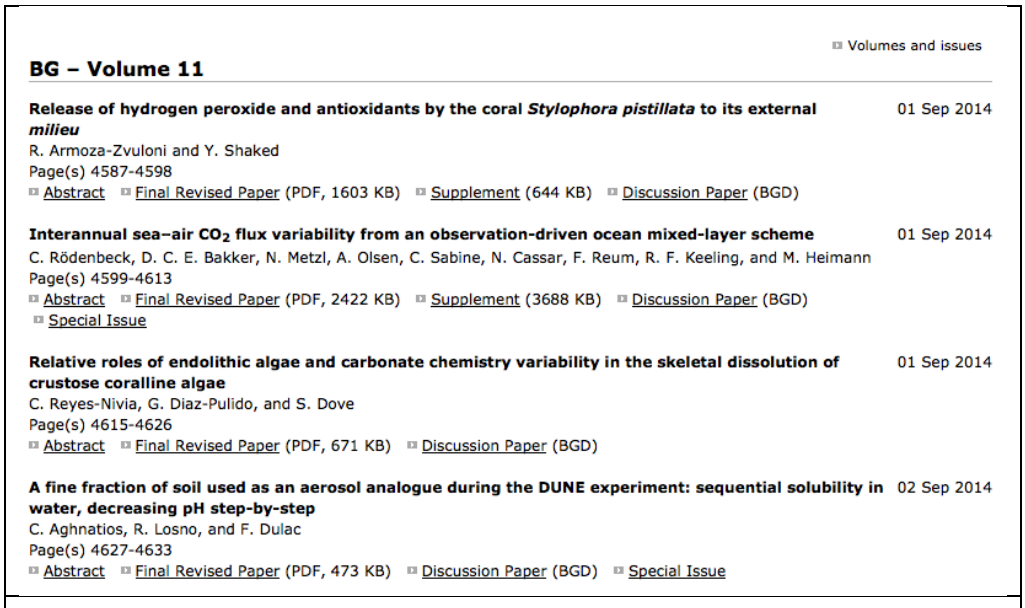
and is spatially displayed according to this role. In other words, each semiotic resource is associated with a module, for instance a section of the IMRaD structure of the scientific research article (see Figure 21).

3) So far two criteria have allowed defining four different strategies ('promotional', 'intra-modal', 'inter-modal' and 'trans-modality'): the criterion 'location of the semiotic resources in the website' (at the article level versus at the journal level) and the criterion 'modularity versus linearity'. These criteria concern the visible manifestation of a strategy, which will be more accurately characterised in the second loop of analysis (see 4.3). In order to propose the most complete picture of the actual situation in scientific journals regarding semiotic resources, in the following, the default situation is recalled and two supplementary strategies are added to the four previous ones. These strategies can be defined as unintentional, or at least not totally intentional. The purpose of the oxymoron 'unintentional strategy' is to identify a set of practices that do not fundamentally challenge or transform the "classic article" (BJ Classic n.d.), i.e. a set of strategies that leaves its content structure, navigation structure or layout structure untouched (Bateman and Delin 2001). These strategies are widespread in online scientific journals and therefore worth exploring.

The large majority of current scientific journals do not yet offer the possibility to publish any semiotic resources other than written words and static visuals. This default situation is linked to attitudes and habits that could be interpreted in various ways and would require a separate, comprehensive study. From informal conversations and discussions, it can however be derived that one or more of the following four reasons prevent the use of other semiotic resources beyond written words and static visuals in a contribution: a) other semiotic resources are simply ignored, b) they are not considered to bring any added value (from a communicative viewpoint), c) they are considered technically difficult to integrate in a publication, d) they are supposed to be used in different other contexts of scientific communication rather than in journals (conceived as a formal channel of communication).

As a simple move beyond this default situation, i.e. a first additional strategy consists in offering the possibility to download supplementary or

complementary material associated with a scientific article. This supplementary material could be of two kinds. It can be, first, about data and data sets. For instance, *Biogeosciences* (BG) and *Atmospheric chemistry and physics* (ACP), both published on behalf the European Geosciences Union, mention in their "general guidelines for manuscripts and submission" that "supplementary material, such as data sets, animated visualisation, etc., should be submitted together with the manuscript for peer-reviewed publication" (ACP Submission n.d.). It can be noticed, though, that a large majority of journals with supplementary material consulted during this first loop of analysis give access to textual research materials only (excel sheets for instance) and not multimedia research material (see 2.3.2). For this reason they have not been integrated in the sample of selected journals providing semiotic resources. This same conclusion applies to the second kind of supplementary material concerning "interactive public discussion", "discussion paper" and the like (see Figure 22). This feature of electronic journals is usual today, especially in the context of transparent peer-review systems. But it is still strongly associated with written words. Audio-visual comments or feedback were not found at all as regards scientific journals, even though they would be possible today from a technical viewpoint (see for instance, "Effective Assessment in a Digital Age - A guide to technology-enhanced assessment and feedback", JISC 2010).


Volumes and issues

BG – Volume 11

Release of hydrogen peroxide and antioxidants by the coral *Stylophora pistillata* to its external *milieu* 01 Sep 2014
R. Armoza-Zvuloni and Y. Shaked
Page(s) 4587-4598
Abstract | Final Revised Paper (PDF, 1603 KB) | Supplement (644 KB) | Discussion Paper (BGD)

Interannual sea–air CO_2 flux variability from an observation-driven ocean mixed-layer scheme 01 Sep 2014
C. Rödenbeck, D. C. E. Bakker, N. Metzl, A. Olsen, C. Sabine, N. Cassar, F. Reum, R. F. Keeling, and M. Heimann
Page(s) 4599-4613
Abstract | Final Revised Paper (PDF, 2422 KB) | Supplement (3688 KB) | Discussion Paper (BGD)
Special Issue

Relative roles of endolithic algae and carbonate chemistry variability in the skeletal dissolution of crustose coralline algae 01 Sep 2014
C. Reyes-Nivia, G. Diaz-Pulido, and S. Dove
Page(s) 4615-4626
Abstract | Final Revised Paper (PDF, 671 KB) | Discussion Paper (BGD)

A fine fraction of soil used as an aerosol analogue during the DUNE experiment: sequential solubility in water, decreasing pH step-by-step 02 Sep 2014
C. Aghnatios, R. Losno, and F. Dulac
Page(s) 4627-4633
Abstract | Final Revised Paper (PDF, 473 KB) | Discussion Paper (BGD) | Special Issue

Figure 22: Supplementary Textual Research Materials (BG Article 2014)

Finally, it has been noticed during the first loop of analysis, that there are digital libraries and publishers that provide publishing platforms for accessing scientific journals, as well as reading/viewing environments with various functionalities. JSTOR has already been mentioned. ScienceDirect operated by Elsevier is another example of such a platform/publishing environment. The journal series *Living Reviews* (*Living Reviews in Relativity* is included in the selected sample), can be considered as an example of this additional strategy dedicated to enhancing the reading experience through various functionalities:

> *Living Reviews journals* go beyond the electronic dissemination of traditional print articles. All articles are readable online in HTML, integrated in a highly functional hypertext viewing environment. Sophisticated navigation support is offered for equations, figures, footnotes and references. … Additionally, all references cited in *Living Reviews* articles are collated in online searchable literature databases (LRR Question n.d.).

This 'Enhanced functionalities' strategy is added in the proposed typology even if it can be regarded as a characteristic of digital journals linked to hypertextuality. Any rating system and "article-level metrics" (Fenner 2013:n.pag.) provided by a journal are also representative of this additional integration strategy dedicated mostly to enhancing the reading experience and to improving how articles are consumed. Fenner (2013) includes under "article-level metric … citations, usage statistics, discussions in online comments and social media, social bookmarking, and recommendations (Fenner 2013:n.pag.).

To conclude, it can be said that the six integration strategies implemented in scientific journals that go beyond the dissemination of text and static visuals (the promotional, the 3 multimodal, and the 2 additional strategies), can be mapped onto a continuum (see Table 5). On both extremes of this continuum, for descriptive purposes, a 'weak integration' strategy and a 'strong integration' strategy are placed. The default approach (with its unintentional emphasis on written words only) is located close to the "weak integration" end of the continuum while the "trans-modality" strategy (with its emphasis on multimedia integration) is close to the opposite end of "strong integration". The

'promotional' strategy is situated between the 'default' strategy (the format of the scientific article is not transformed, multimedia content is "compiled" in a dedicated section) and the "inter-modal' strategy (in the case of a video-abstract, the two main semiotic resources used in a article form a new structure together).

Multimodal integration strategy	***Description at the journal level***	***Description at the article level***	***Research article***
From 'weak' integration (from multimedia content) …			
Default approach	A journal similar to its print counterpart (based on written words and static visuals)	HTML format and/or PDF file to be downloaded	"Classic article"
Supplementary file	Strategy associated with the development of electronic journals (hypertextuality)	Data set or Comment paper (to be downloaded) linked to a research article	"Classic article"
Enhanced Functionalities	Different forms of interactivity ("personal space", etc.)	Additional functionalities for navigating, reading, annotating, rating a research article	"Enhanced research article"
Promotional	Specific sections ("multimedia", "images" etc.)	An informational link to the dedicated section is provided in case of a video interview with an author.	"Classic article" (+ additional secondary formats (podcast, video abstract, video tutorial)
Intra-modal	Editorial policy explicitly featuring a multimodal publishing approach	Incorporating semiotic resources (e.g. video, audio-files) in the body of the research article	Multimedia artefact ('Linearity')
Inter-modal	Editorial policy explicitly featuring a multimodal publishing approach	Pairing of two autonomous semiotic resources for a specific purpose (e.g. a textual and a visual resource)	Multimedia artefact ('Bi-modularity', e.g. a video article)
Trans-modal	Editorial policy explicitly featuring a multimodal publishing approach	Semiotic resources as tools supporting a scientific argumentation	Multimedia artefact ('Modularity', e.g. a webtext)
… To 'strong' integration (to semiotic resources for meaning making)			

Table 5: Typology of Multimodal Integration Strategies In Scientific Journals

Some journals can only be described properly by saying that they apply more than one strategy. Indeed some of these strategies, as already discussed, are not mutually exclusive. Nevertheless, some general tendencies became apparent concerning preferred associations from an empirical viewpoint: a) a strategy implemented in a journal, at the article level, is rarely observed in conjunction with a strategy implemented at the journal level; b) the strategy 'promotional' at the journal level tends to be associated with the 'supplementary material' strategy and with the 'enhanced functionalities' strategy at the article level.

4.2.3. The Intra-, Inter- and Trans-modal Integration Strategies

The first loop of analysis was dedicated to answering a first research question: Which multimodal integration strategies underlie the dissemination of scientific multimedia artefacts in multimodal scientific journals? Based on a content analysis of 38 selected journals, the first loop shows, first of all, that it is possible to find online scientific journals disseminating semiotic resources beyond written words and static visuals. Even though the sample studied has been highly preselected, the result of this analysis also shows that advanced multimodal integration strategies are very rare. In focusing specifically on semiotic resources, six multimodal integration strategies could be surfaced.

A first 'promotional' integration strategy is implemented at the journal level and consists mainly of creating a section dedicated to 'multimedia content'. This 'multimedia content' – generally a video interview or a podcast – is intended to promote (and/or complement) a recently published article. It is important to note that the 'linear' organisation of the published article is maintained in this case. This strategy does not rely on potential contributors alone and these promotional multimedia resources can largely be produced in-house.

At the article level, three integration strategies depend on external contributors who provide semiotic resources in a submitted contribution, which will be transformed or converted into a multimedia artefact. It has been noticed that in order to be fully effective an isolated policy encouraging only submissions with multimedia content is insufficient. A more proactive approach and a support

system seem to be required to actually attract submissions based on a multimodal format.

At this stage of the analysis five aspects (understood at the 'journal' level) turn up to be decisive for less conventional semiotic resources making their way into journal articles:

- An explicit editorial policy is mandatory but insufficient: encouraging submissions that make use of semiotic resources beyond text and 2D visuals, as an option among others, is not a sufficient incentive;
- If support or guidance of some sort is provided the prevalence of submissions based on multimodal formats is higher;
- A journal that promotes a specific multimodal format (or as series of multimodal formats), at the article level, as a unique signature – has the capacity to attract more likely submissions in this particular format;
- A journal publishing *systematically* multimedia artefacts in a specific multimodal format is more likely to focus on this activity only. No other dedicated sections disseminating multimedia content is provided. This journal is first and foremost dedicated to publishing articles based on a multimodal format and not to publishing other articles based on a more conventional format.
- Semiotic resources that are included in a scientific multimedia article are used as a material for argumentation and reflection (for meaning making), and are not added merely for illustrative purposes.

Another result of this first loop of analysis is that actual examples of journals can be found that are dealing differently with the linearity-modularity dimension of the published artefact, determining the layout and the navigation structures of a scientific article. Three strategies (implemented at the article level) appeared:

- The 'intra-modal' strategy that consists in incorporating or inserting mainly visual semiotic resources into a standard textual frame;
- The 'inter-modal' strategy orchestrating the interplay between two main types of semiotic resources;

- The "trans-modal" strategy that ties the multiple semiotic resources to the ongoing argumentation.

To provide a complete picture of multimodal integration strategies in scientific journals, a default situation has been reminded and two strategies that are not the focus of this work have been added: the "supplementary material" strategy and the "enhanced functionalities" strategy.

- The 'default situation' is still dominant in most current online academic journals and appears to be based on practices deployed in printed journals;
- The 'supplementary material' strategy, from the viewpoint of semiotic resources used (data sets for instance) seems to approach digitality as a mode of distribution only.
- Finally the 'enhanced functionalities' strategy consists in improving interactivity and readability in different ways at the journal level but also at the article level (semiotic resources – that is icons - are used, for instance, to rate an article, etc.).

In the context of a second loop of analysis the most relevant multimodal integration strategies described in the typology described previously are explored in more detail. In other words, the analysis of the empirical solutions of the equation placed at the core of this work, that have been proposed in the previous section (and developed in terms of different multimodal integration strategies), is supplemented and confirmed, in the next section, by an additional analysis regarding the main characteristics of what is defined as a multimodal scientific journal.

4.3. The Characteristics Shared by Multimodal Scientific Journals

The first loop of analysis helped identifying multimodal integration strategies based on relative, weak or strong acknowledgement and effective use of semiotic resources in scientific journals. This typology is now put in perspective and the previous analysis further developed in light of all the relevant factors or issues, regarding multimodal scientific publishing, addressed in the first two chapters.

More concretely, in the second loop of analysis, comparative case studies based on GMA (Ritchey 2011) are carried out.

In the following, in a first subsection, GMA is briefly introduced (4.3.1), then performed (4.3.2. and 4.3.3). The result of this second phase of analysis is a description of the main characteristics of a multimodal scientific journal. This set of characteristics can be interpreted, in turn, as a set of requirements for launching a multimodal scientific journal.

4.3.1. Comparing 4 Journals Enacting a Multimodal Integration Strategy

Ritchey introduces GMA as a method "for structuring and investigating the total set of relationships contained in multi-dimensional, non-quantifiable, problem complexes. It was originally developed by Fritz Zwicky, the Swiss astrophysicist and aerospace scientist based at the California Institute of Technology" (Ritchey 2011:8). GMA is thus a tool for approaching a problem by attempting to organise its inherent complexity in different relevant and observable dimensions rather than to reduce it to a few, isolated aspects. In the context of the present study, this means that solving the equation 'digital multimodality + scientific publishing', as already mentioned several times, cannot be limited to integrating multimedia (a video, an audio-file etc.) into a piece of work. In consequence, it is necessary, for instance, to define a multimodal integration strategy (as explained in the previous section) and to question how semiotic resources can be used in conjunction, for meaning making beyond illustrative purposes (see Chapter 2) so as to comply with scientific standards (see Chapter 3).

Ritchey reminds us that the term 'morphology' in 'general morphological analysis' comes...

> ... from classical Greek (*morphé*) and means the study of shape or form. It is concerned with the structure and arrangement of parts of an object, and how these conform (i.e. fit together) to create a whole or Gestalt. The "objects" in question can be physical (e.g. an organism or an ecology), social (e.g. an organisation or social system) or mental (e.g. linguistic forms, concepts or systems of ideas) (Ritchey 2011:8).

Keeping this definition in mind, GMA is conventionally performed in two main phases: an analysis phase and a synthesis phase. The first one, the analysis phase, is dedicated a) to identifying relevant variables or "the most important dimensions of the problem complex to be investigated" (Ritchey 2011:12) and b) to "assigning each parameter a range of relevant values or conditions" (Ritchey 1998:3). For instance, the 'promotional', 'intra-modal', 'inter-modal' and 'trans-modal' integration strategies, described in the previous section, represent four different values of an important dimension (Integration strategy) of a problem complex defined in this work in terms of an equation to solve (digital multimodality + scientific publishing).

On this basis a "morphological field" is constructed that serves as basis for the second phase of synthesis (Cross-consistency assessment). A morphological field is a matrix in which "each cell … contains one particular 'value' or condition from each of the parameters [dimensions], and thus marks out a particular state or configuration of the problem complex" (Ritchey 1998:3). The following figure is an abstract example of a morphological field based on 4 dimensions or parameters (column A, B, C and D) containing respectively 3, 4, 5 and 2 values (see Figure 23).

Dimension A	Dimension B	Dimension C	Dimension D
Value 1A	Value 1B	Value 1C	Value 1D
Value 2A	Value 2B	Value 2C	Value 2D
Value 3A	Value 3B	Value 3C	
	Value 4B	Value 4C	
		Value 5C	

Figure 23: A Morphological Field with 4 Dimensions and 120 Configurations

The morphological field shown in figure 23 represents all the potential solutions of a problem complex described in four dimensions. In the example provided, a total of 3*4*5*2=120 configurations can be explored. The second phase of GMA is dedicated precisely to assessing the relevance of each of these potential solutions. This is called a "cross-consistency assessment": "the next step in the analysis-synthesis process is to examine the internal relationships

between the field parameters and reduce the field by identifying, and weeding out, all mutually [logically or empirically] contradictory conditions" (Ritchey 2011:13). Ritchey adds that "using this technique, a typical morphological field can be reduced by up to 90 or even 99%, depending on the problem structure" (Ritchey 2011:13) The resulting "manageable" solution space is "the sum total of all internally consistent configurations" (Ritchey 1998:6). In the provided example (Figure 23), it can be expected that the initial morphological field will be reduced more or less to 12 consistent configurations (10% of 120 configurations contained in the initial morphological field).

This resulting solution space can finally be used, for instance, as a tool for decision-making in any kind of organisation. In this case, each "internally consistent configuration" can be discussed, further refined and concretely implemented.

Goals and Guiding Questions

In the context of this second loop of analysis, GMA is used in order a) to compare four scientific journals based on four different multimodal integration strategies and b) to describe the characteristics of a multimodal scientific journal in comparison to other scientific journals disseminating some multimedia content.

To achieve these goals, GMA is however adapted from the conventional protocol previously described. Indeed, regards the first phase of GMA, the most important dimensions involved in journals based on a multimodal approach to scientific publishing have already been identified through both theoretical deduction and empirical induction in the first loop of analysis (see Chapter 2-4). It is therefore possible to accelerate the first phase of GMA. The main task that has still to be performed however is ascribing values to each dimension corresponding to what is disclosed by the editorial board on the website of each selected journal included in the second sample. On this basis, the morphological field 'Multimodal scientific publishing' can be generated (4.3.2 and 4.3.3), interpreted and used in order to generate new configurations of potential multimodal or multimedia journals. Overall, GMA is used here as an approach to answer three questions: 1)

which effective solutions are implemented by each journal concerning each dimension involved in multimodal scientific publishing? 2) How similar or different are these solutions, and finally 3) which primary characteristics are shared by all multimodal journals in comparison to a multimedia journal?

Selecting a Second Sample of Journals to Examine

The first sample includes 38 journals divided into 4 typological categories according to the multimedia content displayed on the website and the accessibility of this content: 'policy only', 'rare and 2D', 'frequent and systematic', and 'dedicated section' (see 4.2.1). These categories have been further examined in regard to different multimodal integration strategies. On this basis, the main criteria used to select a second sample of particularly relevant journals that allow defining a set of characteristics shared by multimodal journals are defined as follows:

- Accessibility: the content should be fully accessible. As a consequence, journal with 'restricted access' are excluded.
- Actual practice: journals included in the category "policy only" are also not taken into account in this second loop of the analysis.
- Multimodal integration strategies: only journals based on one of the three multimodal integration strategies implemented at the article level are regarded as potential candidates for inclusion in the second sample.
- Frequency: the practice of publishing a multimedia artefact should be recent and regular in the journals to be selected.
- Disciplinary range: the second sample should ideally consist of journals belonging only to each of the disciplinary fields (that is to say not only the sciences, but also the humanities and social sciences).

In accordance with these criteria, four representative journals are extracted from the first sample of 38 journals and included in the second sample.

- *Kairos* in relation to the criterion 'discipline' is classified under 'humanities': "*Kairos* is a refereed open-access online journal exploring the intersections of rhetoric, technology, and pedagogy" (KAIROS About n.d.).

- *Journal of Visualized Experiments* (JoVE) is classified as a 'science journal'. It "is the world's first peer reviewed scientific video journal. Established in 2006, JoVE is devoted to publishing scientific research in a visual format" (JoVE About n.d.).
- *Southern Spaces* is more difficult to define in relation to the criterion 'discipline'. After discussion, it is put under the label 'humanities': "we publish articles … about real and imagined spaces and places of the US South and their global connections" (SSP About n.d.).
- Finally, *Frontiers* "was launched … in 2007" and "is a community-oriented open-access academic publisher and research network" (FRONTIERS About n.d.). *Frontiers* is not strictly speaking a journal but "an academic publisher of peer-reviewed open scientific journals" (FRONTIERS Wikipedia n.d.). It is also self-defined as an "open science platform" or as a "journal series" based on similar principles. Around 50 journals in various fields of "sciences" are currently published by Frontiers. The names of these journals are all following the same naming convention: *Frontiers in Cardiovascular Medicine*, *Frontiers in Energy Research*, *Frontiers in Human Neuroscience*, etc. *Frontiers*, moreover, provides a video section that is shared by all journals and that is particularly active in delivering multimedia content. For this reason, *Frontiers* is included in the second sample.

From the viewpoint of the multimodal integration strategy, three of these journals that systematically publish multimedia artefacts are representative of a multimodal integration strategy employed at the article level. The last journal *Frontiers* is representative of a multimodal integration strategy implemented at the journal level.

- *Kairos* publishes *webtext* "which are texts authored specifically for publication on the World Wide Web", and this "since its first issue in 1996" (KAIROS About n.d.). Kairos is working with the trans-modal integration strategy.
- *JoVE* systematically publishes *video articles* since its inception in 2006. As the label "video article" suggests, JoVE is representative of the inter-modal integration strategy implemented at the article level.

- *Southern Spaces* disseminates "photo essays and images, reviews, presentations, and short videos" (SSP About n.d.) and is linked to the intra-modal integration strategy implemented at the journal level.
- Finally, the promotional integration strategy implemented by *Frontiers* revolves around two specific sections, "Images" and in particular "Videos" (at the journal level). The analysis of the different functionalities implemented at the article level, such as "view article impact", is not part of the present work. These functionalities are linked to a strategy that is summarised in the following quote: "we are driving innovations and new technologies around peer-review, article and author impact metrics, social networking for researchers, and a whole ecosystem of open science tools" (FRONTIERS About n.d.).

Identifying the Main Dimensions of Analysis

The documentation disclosed on the website of a journal remains the primary source of information throughout this second step. Additional sources of information have been included in some cases for verification purposes (in particular a Wikipedia page or a blog associated with a journal, or a case study dedicated to a journal). Personal communications with journal editors constitute another source of complementary information.

The first analysis phase regards GMA is about collecting relevant dimensions constituting a given problem complex. The metaphor of an equation (digital multimodality + scientific publishing) has been used throughout this work to define the 'problem complex' to solve. Important dimensions to be taken into account in the process of solving this equation have been addressed in two theoretical chapters (see Chapter 2 and 3). These relevant dimensions related to multimodal scientific publishing in journals are now introduced following the four basic phases of the conventional scientific publishing cycle from composition/submission and evaluation to dissemination, and consumption.

Regarding the phase of composition and submission, the most relevant dimensions, already discussed either from the viewpoint of the 'digital

multimodality' term of the equation, or from the viewpoint of the 'scientific publishing' term of the equation, are the following:

- The dimension 'Multimodal integration strategy' that has already been analysed (see 4.2) is defined as a decisive dimension regarding the definition of a journal based on a multimodal approach to scientific publishing. It defines the overall approach of a journal in respect to semiotic resources to be included in the multimedia artefact to be published. The 'default approach' logically excluded, six possible values have already been associated with this dimension ('supplementary material', 'enhanced functionalities', 'promotion', 'intra-modality', 'inter-modality', 'trans-modality'). Only the last four are relevant for the purposes of this second phase of analysis.
- The dimension 'Multimodal format' (see 3.1.1) contributes to reunite an author and a journal around a same project: publishing a scientific article, and a scientific research article in particular, as a multimedia artefact. The dimension 'Multimodal format' is linked to the multimedia artefact eventually published by a journal. In order to collect information related to this dimension, the following questions are asked for every journal included in the second sample: what is the multimodal format promoted by a journal? Is it specific or is it described as a general category (e.g. original article, etc.)?
- The dimension 'Scientific purpose' is now introduced. The question to be asked is related to the scientific purpose or the added value of a multimedia artefact made up of a variety of less conventional semiotic resources. As mentioned on several occasions (see 2.2), a multimodal approach to scientific publishing is more than integration of multimedia content on the one side and semiotic resources are not incorporated for illustrative purposes only on the other side. Consequently, the dimension 'Scientific purpose' questions the actual function of the semiotic resources integrated in a multimedia artefact and promoted in a multimodal format.
- The dimension 'Support process' refers indirectly to all team members involved in the process of producing concretely a multimedia artefact. As already mentioned (see 4.2.3), the role of the support team seems particularly important: inviting contributors to submit a multimedia artefact without providing guidance and/or personal support to further developed a project

does not seem sufficient to attract effective submissions. In order to collect information related to this dimension, the questions raised are therefore that of a dedicated staff in charge of the technical aspects involved in the process of producing a multimedia artefact on the one side and of a specific procedure intended to guide the design of a multimedia artefact on the other side.

The two following relevant dimensions are still related to the first phase of the scientific publishing cycle. They are specifically intended to question the different categories and the types of semiotic resources that a journal takes into account in the context of dissemination of a multimedia artefact.

- The dimension 'Semiotic Input' is related to the fact that multimodal journals disseminate semiotic artefacts made up of a variety of semiotic resources beyond text and 2D visuals. For analytical purposes, a decision was made to focus especially on four categories of semiotic resources in this work: video, audio, animation (or 3D objects) and application (or software) (see 4.2.2). A guiding question to be asked regarding this dimension is the following: how is a submission made to a journal? Is it a full proposal - i.e. is it a finished multimedia artefact (with all its semiotic resources), ready to be reviewed? Or is it a manuscript describing the multimedia artefact to be published after completing the different steps of a process of production?
- The dimension 'Research materials' is about the different types of multimedia research materials and multimedia recordings accepted by a journal and integrated in a published multimedia artefact. Is a scientific research article or another type of scientific article made available on a website of a journal (based on a multimodal approach to scientific publishing), still dedicated to disclosing mainly research findings or, as a multimedia artefact, does it also include some multimedia recordings (associated with the category 'empirical data') or some multimedia research materials (associated with the category 'processed data') (see 3.3.2) linked to the different phases of the research process?

For the purpose of the current analysis, only one publishing environment – the scientific journal – is investigated in consideration of the essential role it

continues to play within the scientific community. At a global level, two series of questions are asked regarding first the 'journal concept' and the 'publishing scenario' of such a publishing environment

- As regards multimodal scientific publishing, is a journal still conceived as a channel for disseminating research findings? Is it still considered either as an archive or as a forum of discussion? Or, alternatively, is it approached as a lab, an incubator etc. - i.e. as an instrument or as tool? That is, is a journal based on a multimodal approach to scientific publishing understood first and foremost, as anticipated before (see 4.2), as a tool for transforming a wide range of semiotic resources into a multimedia artefact?
- Derived from the previous dimension, the dimension 'Publishing scenario' questions, still at a global level, how the different phases of the scientific publishing cycle (see 3.3) are approached in a journal disseminating semiotic resources. Are the four phases of composition/submission, evaluation, dissemination and consumption performed simultaneously as it is the case, for instance, in a journal "open access journal offering rapid publication and open peer review" (F1000 Research n.d.)? Alternatively, are the four phases conceived as four sequential and successive stages as it is the case in a traditional print journal? The dimension 'Publishing scenario' is thus related to the underlying process of resemiotization that leads to the production of a multimedia artefact.

Two dimensions are associated with the second phase of evaluation of a scientific multimedia artefact:

- The dimension 'Review system' covers the different aspects that come into play during the process of evaluating/assessing a scientific multimedia artefact, from its design to its scientific content. This evaluative dimension is decisive regarding the recognition of a multimedia artefact as a scientific article *per se*. It is also decisive regarding the 'trustworthiness' function of a journal (see 3.3.1). Regarding the dimension 'Review system', the question to be asked is the following: how is the multimedia artefact evaluated and/or assessed? As a scientific article first – that is in accordance with scientific standards? As a multimedia artefact – that is in accordance with a specific

multimodal integration strategy? Or is it assessed as a whole – that is as a scientific multimedia artefact in all its aspects and forms (design, technological requirements, scientific standards etc.)?

- The dimension 'Publishing conduct' is also associated with the second phase of evaluation. This dimension is aimed to address all the rules of ethics and deontology (see 3.3.1) – that is aspects questioning the publishing conduct (Lafollette 2000:1335) of authors and contributors submitting audio-visual resources (issues related to privacy rights or use of animal in an experiment) and/or reproducing/reusing (copyrighted or not) multimedia materials. What specific policy is applied in this domain and in all these cases?

The next two dimensions address the conventional 'archiving' and 'publicity' functions of a journal linked to the third dissemination phase of a multimedia artefact:

- The dimensions 'Archiving policy' focuses specifically on the second main functions fulfilled by a scientific journal – accessibility (see 3.3.1) – and how these functions is preserved in the context of a multimodal approach to scientific publishing. This dimension is associated with the dissemination phase of the scientific publishing cycle. As noted earlier (see 3.3), accessibility and use over time of scientific multimedia artefacts, especially for scientific purposes, are a strong requirement regarding multimodal publishing, and even more so when seen in the context of a rapid or "planned obsolescence" (Fitzpatrick 2011a:1) of digital objects. How is this dimension taken into consideration in a multimodal scientific journal? Is it possible to find and describe specific archiving mechanism anticipating this rapid obsolescence of digital technologies or of software used for "running" part or totality of a multimedia artefact?
- In a complementary manner, the dimension 'Registration mechanism' focuses specifically on the last main functions fulfilled by a scientific journal – publicity (see 3.3.1) – and how the visibility of a scientific multimedia artefact is approached. This dimension is also associated with the dissemination and the consumption phases of the scientific publishing cycle. In other words, how is a scientific multimedia artefact with all its semiotic resources displayed in

official indexing services or registration systems? What is the indexing and formatting procedure which results in identifying a scientific article both as a scientific article and also as a scientific multimedia artefact? Is a specific "multimedia" identifier assigned to each of its components or is a multimedia artefact considered as a whole?

The next two dimensions 'Publishing model' and 'Mediated object' are associated with the phase of consumption of a multimedia artefact.

- The dimension 'Mediated object' is linked to the way a multimedia artefact is shared and its status. As a digital object (see 3.1.2), is a multimedia artefact editable? Is it possible to make a comment? Is it downloadable? Is it made available as a final product or as an in-progress piece of work? Is it made of reusable components? In brief, is a scientific multimedia artefact "editable, interactive, reprogrammable, and distributable" (Kallinikos et al. 2013:357)? This also raises the issue of readership and the status of a "reader". Is s/he a user, a consumer, a reader, a 'commentator' or is it considered also as a co-authors?
- The dimension 'Publishing model' is intended to question how a multimedia artefact is made available to the public or an audience, and when? Is it possible to identify, in the second sample of selected journals, a specific publishing model intended to address multimodal scientific publishing specifically? That is to say, is it possible to say that multimodal publishing is based on a specific and innovative publishing model, as electronic scientific publishing was first associated with the open access model? To conclude, it is important to note that eventually the dimension 'Publishing model' is not separate from the issue of affiliation. Is a multimodal journal linked to a commercial or an institutional publisher? Is it an autonomous editorial initiative?

For the purpose of the current analysis, only one publishing environment – the scientific journal – is investigated in consideration of the essential role it continues to play within the scientific community. At a global level, two series of questions are asked regarding first the 'journal concept' and second the 'publishing scenario' of such a publishing environment. These two dimensions

are intended to gives an overall view of the concept on which each of the four journals, understood as a multidimensional system, relies (dimension 'Journal Concept') and consequently how the scientific publishing cycle is approached (dimension 'Publishing scenario) in relation to this 'journal concept'.

- As regards the dimension 'Journal concept', is a journal still conceived as a channel for disseminating research findings? Is it still considered either as an archive or as a forum of discussion? Or, alternatively, is it approached as a lab, an incubator etc. - i.e. as an instrument or as tool? That is, is a journal based on a multimodal approach to scientific publishing understood first and foremost, as anticipated before, as a tool for transforming a wide range of semiotic resources into a multimedia artefact?
- Derived from the previous dimension, the dimension 'Publishing scenario' questions, still at a global level, how the different phases of the scientific publishing cycle (see 4.1) are approached in a journal disseminating semiotic resources. Are the four phases of composition/submission, evaluation, dissemination and consumption performed simultaneously as it is the case, for instance, in a journal "open access journal offering rapid publication and open peer review" (F1000 Research n.d.)? Alternatively, are the four phases conceived as four sequential and successive stages as it is the case in a traditional print journal? The dimension 'Publishing scenario' is thus related to the underlying process of resemiotization that leads to the production of a multimedia artefact.

All the dimensions previously described can now be summarised and integrated in the morphological field 'Multimodal scientific publishing' under construction (see Table 6). This 14-parameter field is completed in the next step of GMA as follows: each journal (the four columns of Table 6) are scrutinised in relation to each dimension (represented by the rows of Table 6) (4.3.2). Significant information is then translated as a value and placed in the morphological field 'Multimodal scientific publishing' under construction (4.3.3.).

DIMENSIONS vs. JOURNALS	*Frontiers*	*Southern Spaces*	*JoVE*	*Kairos*
Journal Concept				
Publishing Scenario				
Multimodal Format				
Multimodal Integration Strategy				
Scientific Purpose				
Support Process				
Semiotic Input				
Research Materials				
Review System				
Publishing conduct				
Archiving Policy				
Registration Mechanism				
Publishing Model				
Mediated Object				

Table 6: Digital Multimodality + Scientific Publishing = A 14-Parameter Field

4.3.2. Constructing the Morphological Field 'Multimodal Publishing'

Information and data related to each dimensions included in the 14-parameter field (or the morphological field under construction) are extracted from the documentation provided by the website of the four journals included in the second sample: JoVE, *Kairos*, *Southern Spaces* (SSP) and *Frontiers*. This documentation is coded according to the same principles used in the content analysis performed in the context of the first loop of analysis (see 4.2): the unit of analysis is therefore still placed at the phrase level.

In the following, information and data are disclosed in accordance with the four main phases of the scientific publishing cycle, approached in a sequential manner for reasons of clarity: composition/submission, evaluation, dissemination and consumption. In other words, a multimedia artefact – eventually published by a journal – is followed from its first apparition as a submission to its dissemination as a peer-reviewed article that can be consumed.

At the conclusion of this step, in order to complete the process of constructing the morphological field 'Multimodal scientific journal' and prepared the synthesis phase of GMA, these information and data will be transformed into values. The sum of the values collected for each dimension (the 14-parameter field) consists therefore of a morphological field based on already empirical solutions - that is to say solutions that are currently enacted in four existing scientific journals disseminating multimedia artefacts.

Composing and Submitting a Multimedia Artefact

The four scientific journals included in the second sample are now compared with one another as regard the dimensions associated with the composition/submission phase of the scientific publishing cycle.

JoVE introduces the procedure to be followed to submit a text-based "manuscript" (dimension 'Semiotic resource') in a specific PDF document called "manuscript instructions for authors" (JoVE Submission n.d.). In this PDF document, "JoVE's unique multimedia format" – i.e. a specific multimodal format called a "video article" (Dimension 'Multimodal format') – is mentioned in

relation to a "cover letter" to be provided and intended to explain, "why this work should be published" as a video article. The remaining parts of the document introduce the video article structure (dimension 'Multimodal format') that is expected from a contributor and that is closely modelled on the conventional IMRaD structure. The formal component M (Method), closely paired with the formal component 'Protocol', is especially emphasised:

> The protocol text should provide a detailed description to enable the accurate replication of the presented technique (including set up, materials, actions, conditions, etc.) (JoVE Submission n.d.).

In sum, potential contributors are required to submit a 'semiotic input' which is a project, i.e. a text-based based description of the future multimedia artefact (a video article) produced in-house by JoVE's staff.

In JoVE, the phase of submission is therefore decoupled from the phase of composition (dimension 'Publishing scenario'). Consequently, to support the production of a video article (dimension 'Support process'), a "scriptwriter", a "videographer", and a "professional voice talent" play an active role:

> After your manuscript is accepted, JoVE's Ph.D. scriptwriters translate your manuscript into a video script and tell you what materials and reagents to prepare in advance [dimension Multimedia research materials]. On the day of filming, JoVE sends a professional videographer to your lab to shoot the video. The protocol is typically filmed in one day. Following filming, JoVE edits your video and adds professional voice-over talent to narrate the science shown on film (JoVE submission n.d.).

A video article (see Figure 24) produced by JoVE can be interpreted as an attempt to connect more satisfactorily the empirical and the disseminative phases of the research process to each other and this even though the process of filming is based on an *a posteriori* reconstruction (dimension 'Research materials'). A video article incorporates visually multimedia research materials ("materials and reagents", JoVE Submission n.d.).

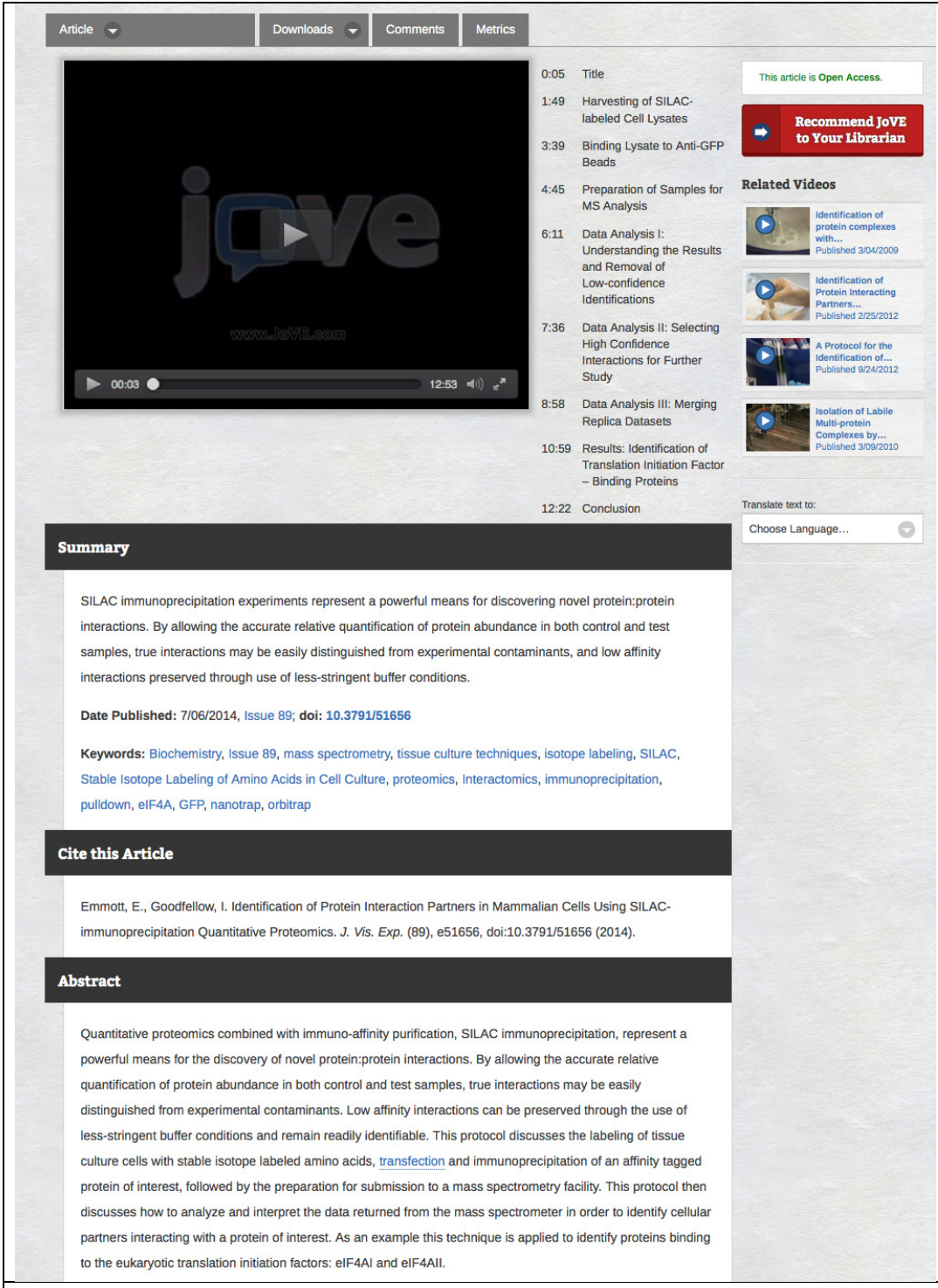


Figure 24: A "Video Article" Published in JoVE

As a process of resemiotization (see 2.2) consisting in transforming words into moving images in order to show gestures, filming helps "researchers overcome two of the biggest challenges facing the scientific research community today; poor reproducibility and the time and labor intensive nature of learning new experimental techniques" (JoVE About n.d.). In doing so, it fulfils its scientific

purpose in a more efficient way what written words achieve only partially. In a magazine article, Fischman chronicles the story that led to the creation of JoVE and shows how written words, as a means for meaning making, can be considered inappropriate in certain contexts:

> Moshe Pritsker [founder and editor of JoVE] was about 30,000 feet above the Atlantic Ocean, with North America head of his airplane and Europe receding, when he began seriously wondering why he was there. The year was 2003, and Mr. Pritsker, then a graduate student at Princeton University, had been to Scotland to learn how to grow stem cells. His adviser had asked him to reproduce a stem-cell experiment published in a prestigious journal. It didn't work. He tried again and failed again. So his adviser put him on a plane to Edinburgh, where the method had been perfected. The young scientist learned the technique. "But on the flight back, I started saying to myself, This is the 21st century. Why should I have to cross the ocean to see 'the master'?," he recalls. "It's a huge waste of time and money. Technology should have a better answer" (Fischman 2012:28).

To conclude, a video article based on an inter-modal integration strategy (dimension 'Multimodal integration strategy') encapsulates in its rhetorical structure the specific functions the verbal component and the visual component fulfil, and also how these two components interact in a complementary manner within a whole.

In contrast to the strict control procedure described in JoVE, *Kairos* is more flexible both in terms of the submitted semiotic input and the promoted specific multimodal format, i.e. a "webtext". A webtext (dimension 'Multimodal format') is explorative by nature: "We do not suggest an ideal standard; rather we invite each author or collaborative writing team to think carefully about what unique opportunities the Web offers" (KAIROS Submission n.d.). This position is linked to the fact that a submission (dimension 'Semiotic input') is first a project: "some projects may best be presented in hypertextual form or in multimedia" (KAIROS Submission n.d.). The fact that a submission is a project and not a finished multimedia artefact is reminded in relation to a specific article type called "topoi": "Submissions are accepted continuously, and authors are encouraged to contact the editorial staff early in their project's development" (KAIROS

Submission n.d.). This suggests that the semiotic input submitted to *Kairos* is not conceived as a document describing precisely the multimedia artefact to be produced, as it is the case for JoVE, but a project-object, or an in-progress multimedia artefact that will be designing step by step during a production process (dimension 'Semiotic input'). This suggests also that submission and composition are approached simultaneously (Dimension 'Publishing scenario') in contrast to JoVE.

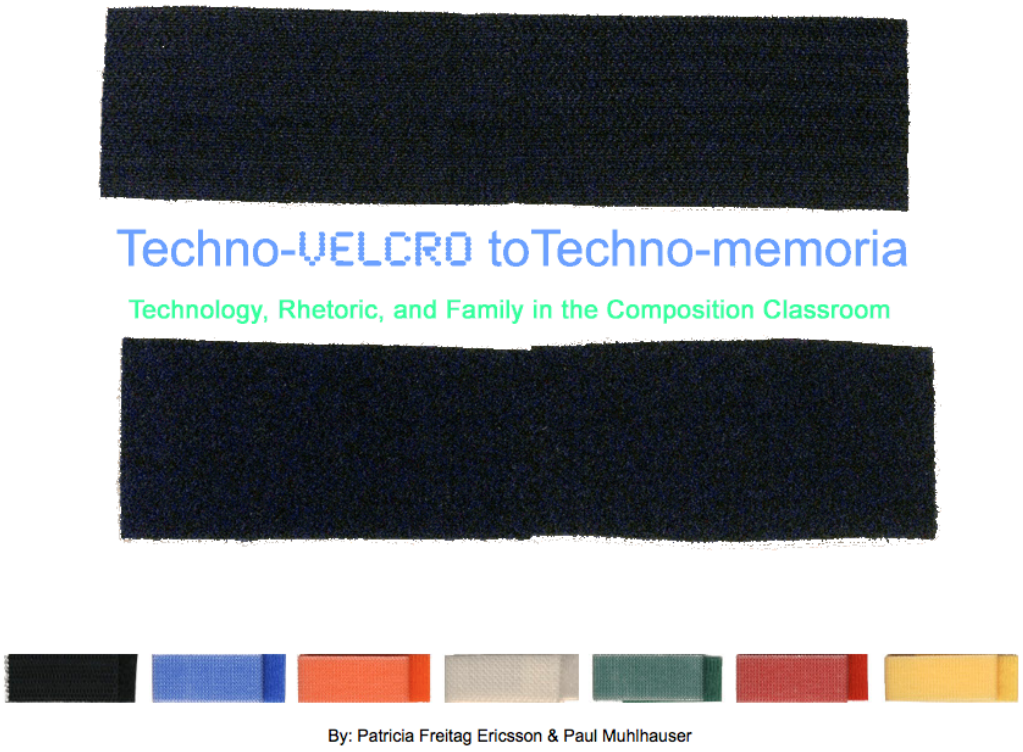


Figure 25: A "Webtext" Published in Kairos (KAIROS webtext 2012)

The webtexts (dimension 'Multimodal format') published by *Kairos* (see Figure 25) do not rely on an inter- but on a trans-modal integration strategy. Consequently, *Kairos* makes clear first that "we're not looking for a standard, text-based article written in a word processing program such as Microsoft Word or a similar program" (KAIROS Submission n.d.). In accordance with this policy, a webpage called "The *Kairos* Style Guide" describes different "design requirements" (KAIROS Style n.d.). Second, the always-changing semiotic resources used in an always-changing webtext are not linked to predefined

functions, as this is the case for the standardised video article format. In contrast to a video article, a webtext is not dedicated to showing how to reproduce an experimental protocol, but to performing and enacting a "scholarly argument" (Dimension 'Scientific purpose'). In other words, a webtext as a multimodal format is a "toolforthought" (Schaffer and Clinton 2006:283) (see 2.2.1): on the one hand, it is a tool that facilitates and enacts a "rhetorical and aesthetic argument" and on the other it is a "scholarly argument that is instantiated in the use of media and design" (KAIROS Submission n.d.). In sum, and as it is the case for JoVE's video article, "all media and design elements [of a webtext] should be non-gratuitous", i.e. they are intended to fulfil a specific scientific purpose.

In contrast to JoVE, *Kairos* does not make totally clear which research materials might be incorporated in a webtext. However, the dimension 'Research materials' in *Kairos* can be inferred from the notion of "webbed forum" highlighted in the following words of the founding editor of *Kairos*, Mick Doherty, as they appear on Kairos' website:

> This new journal has a great deal to do with *kairos*, particularly in terms of its appropriateness and timeliness in our field at this time. As we are discovering the value of hypertextual and other online writing, it is not only important to have a forum for exploring this growing type of composition, but it is essential that we have a *webbed* forum within which to hold those conversations" (KAIROS About n.d.).

In other words, a webtext, as a multimodal format, seems closely related to the formal components D (Discussion) of the IMRaD scientific article. As a form of conversation finally, a webtext is not a report nor a tutorial dedicated to showing the invariable steps of an experiment but a narrative intended to translate with scientific rigor the ebbs and flows of an argumentative discussion. Overall, it tends to reconnect or to connect more significantly two phases of the research process: 'communicate the results' and 'apply the results' (Björk 2007): a webtext is not discussing multimodal composing but learning by doing multimodal composing.

Regarding the dimension 'Support process', *Kairos* is based on a collaborative process of composition, a mentoring process. In a recent publication, C. E. Ball, the current editor, describes at the end of an article how *Kairos* "mentors authors to revise their webtext" (Ball 2014:1). Ball summarises this collaborative process or draft process as follows:

> My goal here has been to show how revision can be approached as a collaboration between authors and editors (students and teachers, and vice versa) in a writing process where multiple drafts should be expected and encouraged, particularly for writers new to certain genres (Ball 2014:13).

Southern Spaces "publishes six different genres of scholarship: articles, photo and media essays, short videos, presentations, reviews, and blog posts" (SSP Submission n.d.). Among these "six publication types", the first four are particularly based on a multimodal format. The last two are "primarily textual submissions". Regarding the dimension 'Multimodal format', "articles" (see Figure 26) disseminated on SSP website are "digital projects" that "incorporate multimedia, but they may start out resembling journal articles composed for print-based scholarly periodicals" (SSP Submission n.d.). In that last case, a support (dimension 'Support process') is provided during the phase of composition/submission:

> Realizing that few scholars are experts in online design, we are eager to work with authors, photographers, and videographers in the process of producing image, sound, and video files for submissions. We are committed to assisting scholars at varying levels of technological proficiency (SSP Submission n.d.).

Southern Spaces (SSP) is based on an intra-modal integration strategy. It implies that words display in a linear way on a webpage influence strongly the layout and the navigation structures of an "article" (dimension 'Multimodal format). Other semiotic resources from this point of view are "incorporated" in this architecture. As it is the case for a webtext (*Kairos*), they are used as tools to present an argument.

"Puerto Ricans Live Free": Race, Language, and Orlando's Contested Soundscape

Tweet

e-mail

Simone Delerme, University of Mississippi

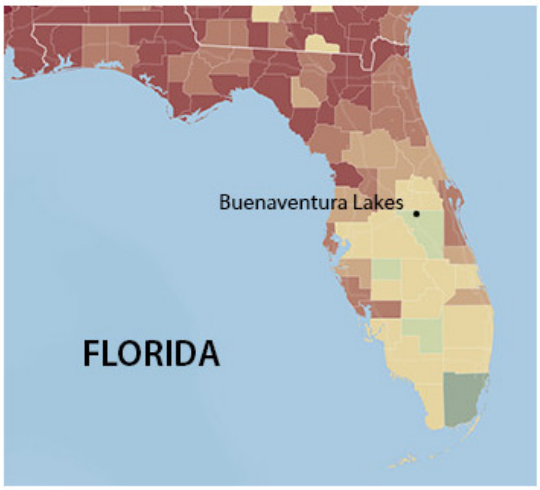
Published: 24 March 2014

Overview:

This article examines social interactions and conversations to reveal how language ideologies—ideas, perceptions, and beliefs about the nature and usage of language—affect racial categorizations and responses to Hispanic migration. Since the early 1980s, metropolitan Orlando, Florida, has experienced an influx of Hispanics, primarily Puerto Ricans, who are transforming its physical landscape, politics, as well as social and cultural life. This article describes the formation of a Puerto Rican enclave in what was once a rural place in Central Florida. Demographic changes and Latinization altered the soundscape as Spanish became increasingly present. Studying the discourses that circulate about language, Hispanic migrants, and Hispanic-concentrated spaces, this article reveals the tensions that arise in new migration destinations.

Introduction

One of the largest Puerto Rican enclaves in Greater Orlando, **Buenaventura Lakes** (BVL), population 26,079, is located in **Osceola County**, Florida.[1] According to the 2010 census, Puerto Ricans comprised 44.5 percent (11,618) of the total population, Mexicans were 2.2 percent (585), Cubans 3.1 percent (799), and other Hispanics or Latinos 19.8 percent (5,158). On June 17, 2008 an Internet user by the name of Poodlestix posted an entry on **City-Data.com**, a website that includes statistical data and conversational forums about US cities, to inquire about the reputation and place-identity of Buenaventura Lakes:



Buenaventura Lakes, Florida. Data from the 2010 Census, Hispanic population according to county. Map courtesy of *Southern Spaces.*

> I was looking at homes with the realtor and found a house at the corner of Lakeside and Anhinga that I really liked. I heard some loud music playing a couple of doors down that evening, and it kind of got me concerned about the neighborhood. I also noticed a broken window on the side that faces Lakeside which looked like it could possibly have been made by a bullet. Is that possible? I'm not familiar with whether this is a good neighborhood, but I loved the house.[2]

Figure 26: An "Article" Published in Southern Spaces (SSP Article 2014)

From this standpoint, the multimodal format 'Short video' is described as a format that "uses visual – as opposed to textual or rhetorical –techniques to advance a critical argument" (SSP Submission n.d.). More precisely, an "article" makes use of "textual, archival, and ethnographic data [dimension 'Research materials'] to challenge conventional ways of understanding the people, places, and cultures found in the South" (SSP Submission n.d.). For these reasons, the function of the semiotic resources "incorporated" in an article is twofold. They are illustrations as well as testimonies used "to challenge conventional ways of understanding the people, places, and cultures found in the South". In other words, they provide visual and spatial evidence.

Overall, an "article" published by Southern Spaces is an interpretative work of a culture based on an ethnographic approach. It can be concluded from this perspective that the multimodal format "article" as conceived by *Southern Spaces* tends to emphasise the formal component R (Result) and thus reconnect the empirical phase and the disseminative phase of the research project.

Finally, *Frontiers*, as already mentioned, does not disseminate multimedia artefacts based on a specific multimodal format (dimension Multimodal format) and does not approach a video in conjunction to a specific scientific article type but as complementary and promotional material or multimedia content. Based on a promotional integration strategy, the keyword associated with the video section available on Frontiers' website is communication: the video format (see Figure 27) is used as a communication tool for various purposes: announcing an event, a conference, an upcoming paper (video abstract). It archives also talks and lectures.

The video section is only introduced by means of a few lines insisting on the communicative functions (dimension 'Scientific purpose') of such a semiotic resource. No support process is mentioned:

> Frontiers Videos is a platform which allows you to share pertinent videos instantaneously with the entire community. Whether the recording of a lecture, discussion of a new research project or presentation of an award ceremony, Frontiers Videos is an easy to use and simple method of communication which

further establishes your presence in your field or specialty area (FRONTIERS Community n.d.).

No instructions are specifically associated with the use of the video section in terms of semiotic input.

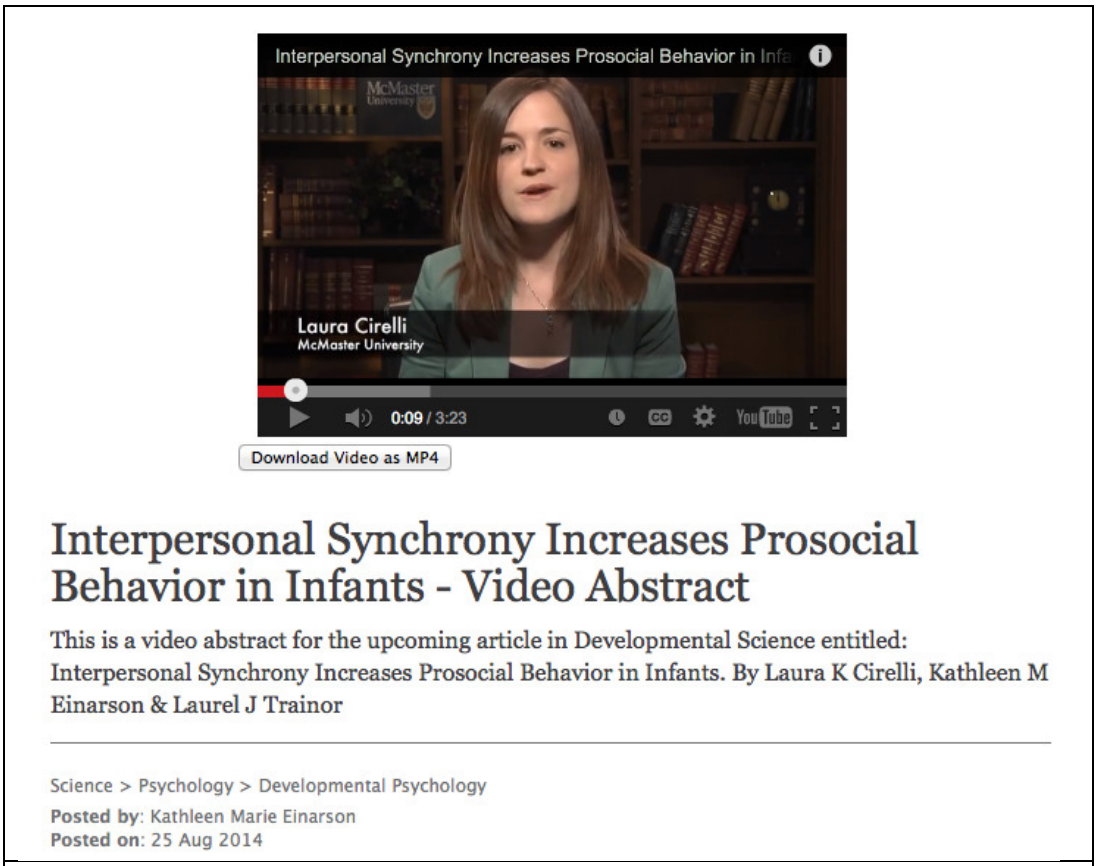


Figure 27: A "Video" Published in Frontiers

The following summary table (Table 6) gives an overview of information collected for each dimension related to the phase of composition/submission of a scientific work and this for each journal under scrutiny.

DIMENSIONS vs. JOURNALS	***Frontiers***	***Southern Spaces***	***JoVE***	***Kairos***
Multimodal Format	None	Article (with multimedia). + Photo and Media essays. Short Video	Video article	Webtext
Multimodal Integration Strategy	Promotional strategy	Intra-modal strategy	Inter-modal strategy	Trans-modal strategy
Scientific Purpose	Promoting and making a future work visible (Visibility)	Advancing a critical argument	Reproducing an experiment (Reproducibility)	Producing a scholarly argument
Semiotic Input	Video	A digital project-object	A text-based manuscript and a text-based cover letter describing a project	A project-object
Research Materials	[Esp. Component Introduction, i.e. Abstract]	Data [Esp. Interpretive and disseminative phases, i.e. Recording evidence]	Multimedia research materials [Esp. Component M or Protocol]	[Esp. Component Discussion]
Support Process	None	Collaborative submission process (Support team: Editorial board members).	In-house Production (Support team: Scriptwriter, Videographer, Professional voice talent)	Collaborative mentoring process (Support team: Editorial board members)

Table 7: Composing and Submitting a Multimedia Artefact

The four scientific journals included in the second sample are now compared with one another as regard the dimensions associated with the evaluation phase of the scientific publishing cycle. The dimensions 'Review system' and 'Publishing conduct' taken together describe how editorial boards address the challenges of assessing a contribution that is intended to be a scientific piece of work (the 'scientific publishing' term of the equation) and at the same time a multimedia artefact based on a specific format and design, possibly using different media technologies (the 'digital multimodality' term of the equation).

The review system implemented in JoVE is organised around the submitted "manuscript" (dimension 'Semiotic input'). There are two major stages in the process: "You submit an original manuscript according to JoVE's guidelines, which must complete internal editorial review and then external peer review to be accepted for publication" (JoVE Submission n.d.). It follows from this short description that the review system is conducted to determine the scientific validity of a submission and whether the process of production of a video article should be initiated. It is therefore not designed to evaluate the scientific quality of the finished multimedia artefact and the overall quality of design.

In the "manuscript instructions" or author guidelines for the preparation of a contribution providing by JoVE, regarding the dimension 'Publishing conduct', a note states that "all methods including the use of human or animal subjects and/or tissue or field sampling must include an ethics statement before the numbered protocol section" (JoVE Submission n.d.).

In comparison to JoVE, the review system in *Kairos* revolves around a collaborative approach (a mentoring process) dedicated to assessing the design of the multimedia artefact to be published. Consequently, "in the course of our editorial review process, you should expect editorial staff and editorial board members to analyze your choices carefully, so please be sure to think them through" (KAIROS Submission n.d.). The review system in *Kairos* is therefore complemented by a 'design edit' phase dedicated to ensuring "that webtexts are ready for publication". More precisely "the design edit consists of checking for

readability, accessibility, usability, and sustainability. Design-editing, just like copy-editing, is a practice in negotiation with the author's design-voice" (KAIROS Style n.d.). In sum, in *Kairos*, the phase of composition/submission and the phase of evaluation appear to be closely connected with each other (Dimension Publishing scenario).

Regarding the dimension 'Publishing conduct', from an ethical viewpoint, in a short note "human subjects" are mentioned: "Authors submitting work to *Kairos* are responsible for securing and archiving any human subjects' permissions pertaining to their research" (KAIROS Style n.d.). Still in relation to the dimension 'Publishing conduct', *Kairos* explains that...

> ... because questions of copyright, intellectual property, and fair use often arise for scholars who wish to create digital publications, we have developed a statement of copyright that encourages authors to carefully consider their rights and responsibilities while advocating for a strengthening of fair use. Our copyright statement also provides authors with the opportunity to build upon and republish their work (KAIROS About n.d.)

In *Southern Spaces* (SSP), a double-blind review process – that could be described as conventional – starts once the submission process is completed (dimension 'Publishing scenario'): If the editorial staff and senior editor determine that a submission is ready for peer review, the piece then proceeds to double-blind review by two scholars with expertise in fields relevant to the submitted work" (SSP Submission n.d.). During this review process, reviewers are asked to "evaluate the submission … with respect to … academic rigor … and overall presentation". As for the dimension 'Publishing conduct', "authors are responsible for acquiring the rights to use all media (SSP Submission n.d.).

A video posted on the *Frontiers* website is not subject to peer review, whereas conventional (i.e. text-based) contributions are evaluated through a two-step process made of an independent review and an interactive review. It is interested to note that this last step is carried out by means of a review forum "acting like a personal Web 2.0 assistant" and "that guides authors, reviewers and editors smoothly through the process and alerts them when action is required"

(FRONTIERS Forum n.d.). Nevertheless concrete examples of the use of this 'interactive forum' tool could not be found in order to check, for instance, if auditory semiotic resources (i.e. audio-visual feedback) are made available through this process.

As for the use of the video section in terms of ethics and deontology (dimension Publishing conduct), to upload a video it is necessary to be registered as a member and to accept the "conditions for registered users". This document defines, at a global level and *a priori*, the general terms and conditions of use applied to "any and all contributions, and to any services associated with such contributions" (FRONTIERS Users n.d.).

Table 7 gives an overview of information collected for each dimension related to the phase of evaluation of a multimedia artefact.

DIMENSIONS vs. JOURNALS	***Frontiers***	***Southern Spaces***	***JoVE***	***Kairos***
Review System	None [+ "Interactive review process, "a web 2.0 assistant"]	Double-blind review process (academic rigor and overall presentation)	Internal editorial review and external peer review of the manuscript (scientific quality)	Editorial review process with a 'design edit' phase (scientific quality and quality of design)
Publishing conduct	General conditions for registered users	Author's responsibility (copyrighted material)	Author's responsibility: a text-based "ethics statement" (use of human and animal subjects).	Statement of copyright (copyrighted multimedia material). Author's responsibility (human subjects permissions)

Table 8: Evaluating a Multimedia Artefact

As mentioned (see 3.1.2), the rapid technological obsolescence is an important factor to be taken into consideration in approaching multimodal scientific publishing, as a note published by Vectors reminds us (see Figure 28). Which mechanisms are therefore in place in the four journals under scrutiny to ensure that a multimedia artefact remains accessible over time and moreover accessible in its original state and design? Similarly, how is its multimodal format indexed and promoted through an identifier? These questions are now examined in relation to two dimensions associated with the dissemination phase of a multimedia artefact.

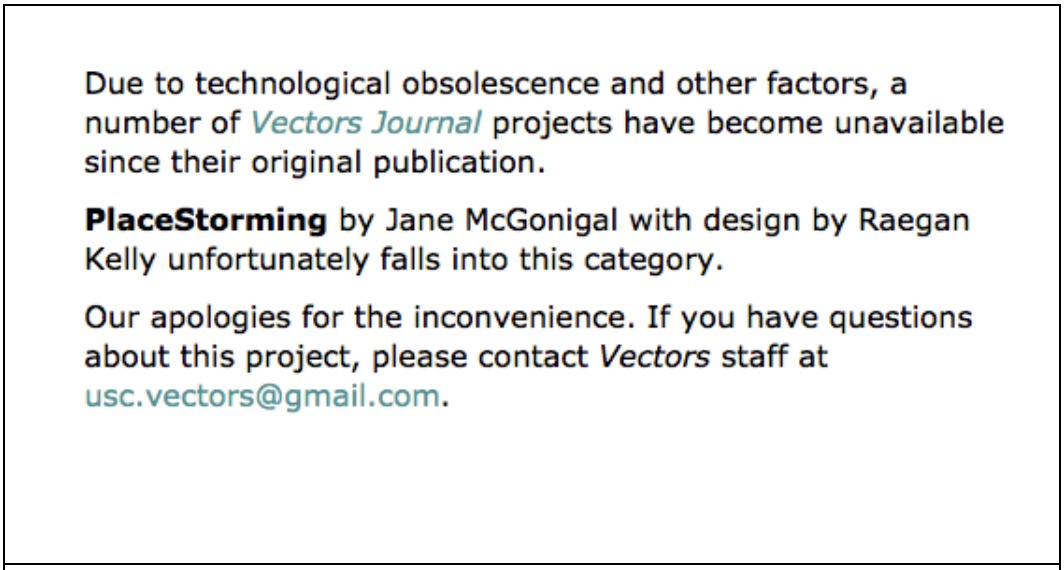


Figure 28. Due To Technical Obsolescence.... (VECTORS Archive n.d.)

Video articles published by JoVE are "indexed in PubMed/MEDLINE, SciFinder and Scopus" (JoVE Information n.d.). PubMed as well as Scopus have been checked but no specific indexing method and registration mechanism has been found for the video component of the video article. Except a clickable icon "watch Video Article at JoVE" (see Figure 29), a video article is indexed as a conventional scientific article and displayed as an abstract with references on both searchable databases. As for the archiving policy, "every article ever published in JoVE, ordered by month of publication" (JoVE Archive n.d.) are available in the section JoVE Archive.

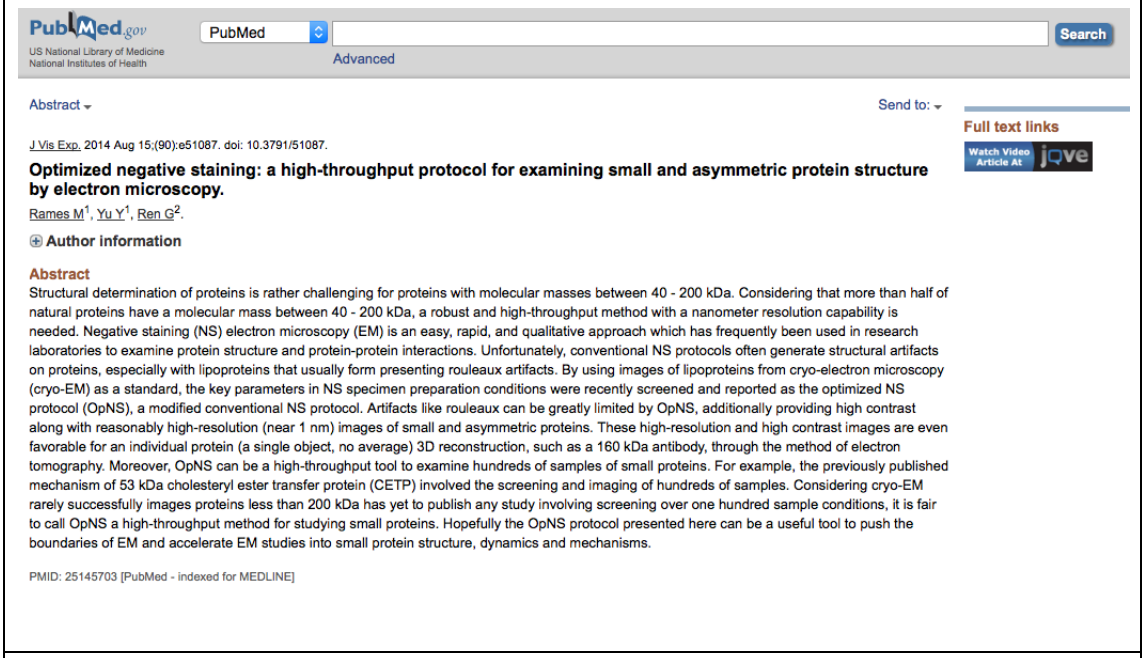

PubMed.gov
US National Library of Medicine
National Institutes of Health
PubMed
Search
Advanced
Abstract
Send to:
Full text links
Watch Video Article At jove
J Vis Exp. 2014 Aug 15;(90):e51087. doi: 10.3791/51087.
Optimized negative staining: a high-throughput protocol for examining small and asymmetric protein structure by electron microscopy.
Rames M[1], Yu Y[1], Ren G[2].
Author information
Abstract
Structural determination of proteins is rather challenging for proteins with molecular masses between 40 - 200 kDa. Considering that more than half of natural proteins have a molecular mass between 40 - 200 kDa, a robust and high-throughput method with a nanometer resolution capability is needed. Negative staining (NS) electron microscopy (EM) is an easy, rapid, and qualitative approach which has frequently been used in research laboratories to examine protein structure and protein-protein interactions. Unfortunately, conventional NS protocols often generate structural artifacts on proteins, especially with lipoproteins that usually form presenting rouleaux artifacts. By using images of lipoproteins from cryo-electron microscopy (cryo-EM) as a standard, the key parameters in NS specimen preparation conditions were recently screened and reported as the optimized NS protocol (OpNS), a modified conventional NS protocol. Artifacts like rouleaux can be greatly limited by OpNS, additionally providing high contrast along with reasonably high-resolution (near 1 nm) images of small and asymmetric proteins. These high-resolution and high contrast images are even favorable for an individual protein (a single object, no average) 3D reconstruction, such as a 160 kDa antibody, through the method of electron tomography. Moreover, OpNS can be a high-throughput tool to examine hundreds of samples of small proteins. For example, the previously published mechanism of 53 kDa cholesteryl ester transfer protein (CETP) involved the screening and imaging of hundreds of samples. Considering cryo-EM rarely successfully images proteins less than 200 kDa has yet to publish any study involving screening over one hundred sample conditions, it is fair to call OpNS a high-throughput method for studying small proteins. Hopefully the OpNS protocol presented here can be a useful tool to push the boundaries of EM and accelerate EM studies into small protein structure, dynamics and mechanisms.
PMID: 25145703 [PubMed - indexed for MEDLINE]

Figure 29: A JoVE Video Article indexed in PubMed (JoVE PubMed n.d.)

Kairos follows the same rule as regards the archiving methods and stores every webtext ever published on the journal website (Dimension 'Archiving policy'). It is specified, though, that "issues before 13.1 are presented in the design in which they were originally published; issues prior to 4.1 are available in the original design or in the more reader-friendly first major redesign" (KAIROS Archive n.d.). Still in relation to this point, *Kairos* indicates: "Authors of accepted webtexts assign to Kairos the right to publish and distribute their work electronically, including publication on the web and on CD-ROM, and to archive and make it permanently retrievable electronically" (KAIROS Submission n.d.).

No specific registration mechanism has been found in *Kairos*. No specific digital or "multimedia" identifier seems to be used for webtext identification. A mention published together with a webtext in the issue 11.1 says that "*Kairos* is indexed in the MLA International Bibliography" (KAIROS Issue n.d.) but this information could not be checked.

Southern Spaces "archives all publication materials through the Digital Programs and Systems of the Robert W. Woodruff Library and is committed to providing a stable digital presence for our content" (SSP About n.d.). This means that "all publications, along with their associated media, are securely archived by

Emory University's Woodruff Library" (SSP Submission n.d.). Nevertheless, relevant information regarding "the digital programs and systems" evoked could not be found. As well as *Kairos* no specific registration mechanism and no specific "multimedia" identifier are mentioned and have been observed.

Articles published in *Frontiers* are indexed in PMC or PubMed and stored on the website. Video made available in the video section is not linked to a specific archiving policy or a registration mechanism.

Table 9 summarises the previous discussion regarding the dimensions 'Archiving policy' and 'Registration mechanism' for each journal of the second sample. These dimensions are related to the phase of dissemination of a multimedia artefact.

DIMENSIONS vs. JOURNALS	***Frontiers***	***Southern Spaces***	***JoVE***	***Kairos***
Archiving Policy	Website	Digital library (external program)	Website	Website
Registration Mechanism	No specific digital identifier	No specific "multimedia" identifier is associated with an article or a semiotic resource	DOI. A video article is indexed as text (+ clickable icon)	No specific "multimedia" identifier is associated with a webtext or a semiotic resource

Table 9: Disseminating a Multimedia Artefact

Consuming a Multimedia Artefact

The dimensions 'Publishing model' and 'Mediated object' are dedicated to comparing how a multimedia artefact is expected to be consumed from the viewpoint of the editorial policy of each journal included in the second sample.

JoVE is a subscription-based journal and is mostly based on a relation between customer and supplier, and authors are also "charged a production fee" (standard access 2400$, open access 4200$) (JoVE Information n.d.). As an illustration for this relationship, after the production process of a video article is completed, the researcher-client gets "a chance to approve [the] final video and manuscript after video editing in the 'Galley Proofing' stage". The choice of a subscription-based publishing model is explained as follows:

> Most JoVE video articles are filmed and edited by video professionals. Since video production is very expensive, the cost per article for JoVE is much higher than for traditional, text-only publications. It is not possible to cover the costs of video production based on the typical open-access model, in which fees are typically collected from academic authors. Consequently, we made the difficult decision to make a large portion of our content only available to paid subscribers in order to cover these costs (JoVE Subscribe n.d.).

JoVE is a business company that employs a team of around 50 staff members working in different departments (finance, human resources, information technology, marketing, video). Moreover JoVE developed a network of videographers located in different places in the world.

Kairos is a "refereed open-access journal" that "has generated a CC license":

> This license states that anyone is free to copy, distribute, display, or perform Kairos as a whole under the following conditions: you must give the original author(s) credit; you may not use this work for commercial purposes; and you must allow your use of Kairos to be granted the same license terms (KAIROS Submission n.d.).

Southern Spaces is an "open-access journal … freely available to individuals and institutions" (SSP About n.d.).

Frontiers, finally, is based on a publishing approach that is "community driven". This approach, however, is realised only in a minimal way in the video section as a space dedicated to share and comment multimedia content. *Frontiers* is linked to an author-pay model, "which allows us to provide immediate open access to

our entire content". Indeed "open access literature is not without cost to produce". However there is no cost attached to the video section which can be used freely by any registered member.

Overall, extensive information related to the way a multimedia artefact is shared online, commented by users (with the exception of JoVE which allows users to comment a video article), or updated by authors (dimension 'Mediated object') have not been found for the four selected journals. It is likely that a video article (JoVE), an article (SSP) or a webtext (Kairos), after dissemination, is considered either as a finished multimedia artefact that cannot be updated or as a multimedia artefact that is rarely modified. As for the dimension 'Publishing model', on the basis of the information available, it seems that no specific publishing model is associated with multimodal scientific publishing and its particular constraints. Despite the fact that designing a multimedia artefact is particularly time-consuming (as suggested by *Kairos* and *Southern Spaces*) and finally expensive (as *Frontiers* and *JoVE* reminds us), already existing business and open access models are also used, even if they are not entirely satisfactory.

Table 10 gives an overview of information collected for the two dimensions discussed in relation to the consumption phase of a multimedia artefact.

DIMENSIONS vs. JOURNALS	**Frontiers**	**Southern Spaces**	**JoVE**	**Kairos**
Publishing Model	Open access	Open access	Subscription-based journal and author-pay model	Open access
Mediated Object	None	None	Functionality 'Comment' (+ Metrics)	None

Table 10: Consuming a Multimedia Artefact

The production process of a multimedia artefact

The last two dimensions 'Publishing scenario' and 'Journal concept' are now considered. They are intended to gives an overall view of the concept on which

each of the four selected journals relies (dimension 'Journal Concept') and how, at a global level, the different phases of the scientific publishing cycle is approached as a coherent "scenario" (dimension 'Publishing scenario') in each of the four journals.

As regards the dimension 'Journal concept', JoVE, *Kairos* and *Southern Spaces*, in accordance with the traditional and conventional roles of the scientific journal, can be still understood as a channel for disseminating, discussing and archiving research findings (see 3.3). However, at the same time, they go beyond these roles and they can be interpreted as a tool a) for designing and disseminating a webtext (*Kairos*), b) for experimenting "new ways of organizing and presenting research" (SSP About n.d.) based on multimodal formats (SSP), and c) as a tool for producing video articles (JoVE). From this perspective, whereas JoVE has developed an in-house production process, therefore a service, *Southern Spaces* and especially *Kairos* relies more on a collaborative mentoring process. For this reason, they can be considered as a publishing incubator (*Kairos*) and as a lab (*Southern Spaces*) – that is a tool for composing, evaluating, disseminating and consuming scientific multimedia artefacts.

In line with these journal concepts (a publishing incubator or a service), different publishing cycles can be described (dimension 'Publishing scenario'). JoVE is based on a 5-step cycle that includes: 1) submitting a text-based manuscript, 2) evaluating this manuscript, 3) composing (producing) the video article, 4) disseminating the video article, 5) consuming the video article. As can be noticed, the sequential order of the conventional publishing cycle is changed and the phase of evaluation is placed between submission and composition conceived as two distinct phases. In SSP, the four conventional phases of the publishing cycle are performed, more conventionally, in a successive manner. However, a collaborative process is introduced during the phase of composition/submission to achieve. For this reason, the phase of composition/submission can be considered as a two-step phase. Finally, in *Kairos*, the phase of submission/composition is divided in two phases. The phase of submission of a project and the phase of composition that is closely associated, in turn, with the phase of evaluation. In other words, composition and evaluation

are approached in combination. According to the implemented mentoring process, it seems, consequently, that the phase of composition, in *Kairos*, relies on a formative assessment of a webtext whereas the phase of evaluation relies on a summative assessment of the same webtext.

As for the dimension 'journal concept', the video section available on Frontier's website can be interpreted as a repository of promotional videos or of video resources. The 'publishing scenario' associated with this 'repository' is a two-step cycle that includes a phase of a submission (uploading a video) and a phase of consumption.

Table 11 summarises the previous discussion as regards the overall production process of a multimedia artefact in relation to a specific approach of a journal conceived as a tool

DIMENSIONS vs. JOURNALS	***Frontiers***	***Southern Spaces***	***JoVE***	***Kairos***
Journal Concept	A video section conceived as a repository of promotional videos or video resources	A lab dedicated to experimenting new ways of organising and presenting research based on multimodal formats	A service dedicated to producing and disseminating video articles	A publishing incubator dedicated to designing and disseminating webtexts
Publishing Scenario	1) Dissemination, 2) Consumption	Sequential: 1) Composition, 2) Submission, 3) Evaluation, 4) Dissemination, 5) Consumption	Sequential: 1) Submission, 2) Evaluation, 3) Composition (Production), 4) Dissemination, 5) Consumption	Sequential: 1) Submission, 2) Composition, Evaluation, 2) Dissemination, 3) Consumption

Table 11: The Overall Production Process of a Multimedia Artefact

Distinguishing multimodal journals and multimedia journals

It is now possible to revisit the different dimensions discussed in the second analytical phase in order, first, to describe the four journals investigated at a

global level and, second, to define a multimodal scientific journal in comparison to other scientific journals disseminating some multimedia content. For this purpose, the last dimensions 'Publishing scenario' and 'Journal concept' are now considered.

On the basis of all the dimensions defined in relation to the phases of composition/submission, evaluation, dissemination and consumption of a multimedia artefact, a multimodal scientific journal is now distinguished from other online scientific journals providing users with some multimedia content. To this end, the overall dimension 'Multimodal publishing paradigm' is intended to circumscribe the link that holds all the dimensions together and makes a scientific journal, based on a multimodal approach, a comprehensive multidimensional and dynamic system. It is therefore the glue that holds the methods of composition/submission, evaluation, dissemination and consumption of a multimedia artefact (especially a scientific article) together (dimension 'Publishing scenario').

As regards the four journals included in the second sample, *Kairos*, *Southern Spaces* and *JoVE* are three key examples of multimodal scientific journals based on a multimodal publishing paradigm that permeates every defined dimension whereas *Frontiers* has to be considered as a scientific journal with multimedia content. More precisely, *Kairos*, *Southern Spaces* and *JoVE* are three key examples of multimodal journals that enact a multimodal publishing paradigm, a) which is expressed in particular through a specific multimodal integration strategy, and b) which is make visible through specific multimodal formats aimed to ensure that semiotic resources are approached as means for meaning making in a scientific context. On the contrary, *Frontiers* is an example of a multimedia journal. it disseminates semiotic resources that are not directly intended to fulfil a scientific purpose but a communicative purpose. Its primarily goal is not to produce or design a scientific article that is multimedia artefact based on a specific multimodal format. In sum, it does not rely on a multimodal publishing paradigm that permeates all the dimensions associated with the phases of composition/submission, evaluation, dissemination and consumption of a scientific article.

Nonlinearity (Kalmbach 2006) is the umbrella term for describing the multimodal publishing paradigm of *Kairos*. This publishing paradigm is enacted through a trans-modal integration strategy and a specific collaborative mentoring process (dimension 'Support process'). Nonlinearity is also the characteristic of the multimedia artefact that this journal, conceived as a publishing incubator (dimension 'Journal concept'), is intended to design and publish. Nonlinearity is also at the core of the specific multimodal format (a webtext) promoted by this journal, and dedicating to advancing a scholarly argument through also a nonlinear "narratives" (KAIROS about n.d.).

In a similar vein, *JoVE* is based on a multimodal publishing paradigm that can be summarised by the term "visualisation". This publishing paradigm is enacted through a specific multimodal format – a video article (dimension 'Multimodal format') that allows a user to visualise and then reproduce an experimental protocol – and through an inter-modal integration strategy. Each main semiotic resource of a video article fulfils a specific 'scientific purpose': the visual component is a tutorial and a reminder of the empirical phase whereas the textual component communicates formal results or research findings.

"Presenting" is the verb that can be associated with the multimodal scientific paradigm enacted by *Southern Spaces* through an intra-modal integration strategy and a various multimodal formats ("articles", "photo and media essays" and "short videos"). In line with these two previous dimensions, a support process is implemented that is dedicated to helping researchers "incorporating multimedia" (SSP About n.d.) into the textual architecture of a multimedia artefact. The use of audio-visual semiotic resources (dimension 'Scientific purpose') is intended to challenge "conventional representations" (SSP About n.d.). Overall, the multimodal publishing paradigm that permeates all the dimensions of *Southern Spaces* is dedicated to experimenting "new ways of organizing and presenting research" (SSP About n.d.)

In contrast to *Kairos*, JoVE and *Southern Spaces*, *Frontiers* is not based on a multimodal publishing paradigm. It is described as a multimedia journal, a scientific journal disseminating multimedia content mainly for communicative purposes. A video (dimension 'Multimodal format'), displayed in a video section,

is a communication tool intended to promote scientific works and to give a published article or a researcher more visibility. Overall, *Frontiers* is a collection of academic journals that disseminate audio-visual semiotic resources for communication purposes and not for scientific purpose. In line with this promotional integration strategy, videos and animated slideshows are found at various other locations in the website, in particular on the homepage. This multimedia content is aimed, in these particular cases, to showcase the specific review process implemented by *Frontiers* or highlight the core principles of the journal among others (see Figure 30). The key for describing the publishing paradigm enacted by *Frontiers* is "community" and is therefore not linked to multimodal publishing. The *Frontiers* Journals Series is first and foremost community-driven journals: "*Frontiers* is building up a community system that aims at serving the needs of all research-related communities, ranging from scholars to the public and various types of organizations" (FRONTIERS Glossary n.d.).

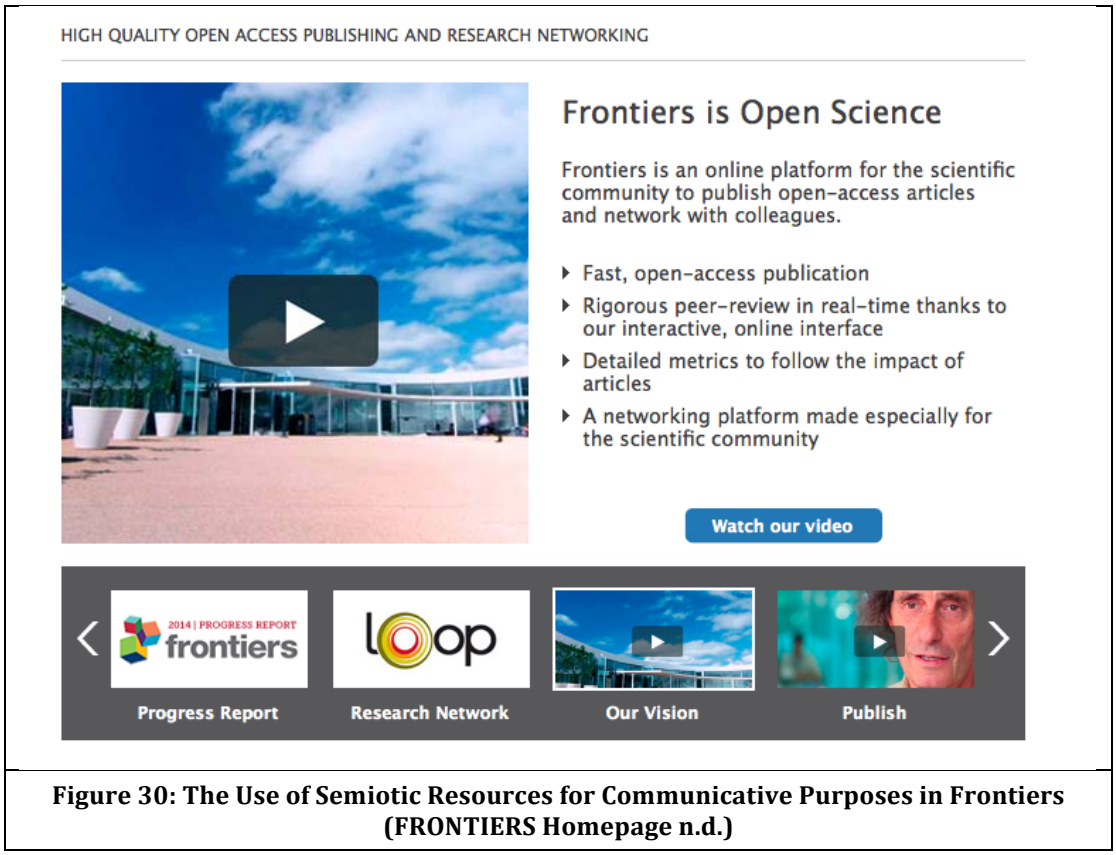


Figure 30: The Use of Semiotic Resources for Communicative Purposes in Frontiers (FRONTIERS Homepage n.d.)

In the following conclusive section, the morphological field 'Multimodal scientific publishing' is generated and the main characteristics shared by multimodal scientific journals are summarised.

4.3.3. The Primary Dimensions of a Multimodal Scientific Journal

In this synthesis phase, the morphological field 'Multimodal scientific publishing' is, first, generated. This morphological field results from empirical solutions obtained through the examination of three sustainable multimodal journals. Defined as a multimedia journal, Frontiers is not considered in this section which focuses exclusively on multimodal journals. In a second step of the synthesis phase, a solution space is inferred from the morphological field 'Multimodal scientific publishing'.

To complete the task of generating the morphological field 'Multimodal scientific publishing', information and data collected during the previous phase (4.3.2) and assigned to each dimension of the 14-parameter field (4.3.1) are scrutinised and translated into values. Considering the values are similar, they are therefore coded with the same generic name. For instance, regarding the dimension 'Semiotic input', "a digital project-object" (SSP) and "a project-object" (*Kairos*) are equivalent and coded in the same way – that is "multimedia object" (as a multimedia object, it is also a first version of a future multimedia artefact). In contrast to *Kairos* and *Southern Spaces*, JoVE requires contributors, a more formal text-based "manuscript" describing a future multimedia artefact. Consequently manuscript is coded "written proposal". These two values – "multimedia object", "written proposal" represent the "spectrum of 'possible' values" (Ritchey 2011:15) of the dimension 'Semiotic input'. This same method is applied to each dimension.

In the following, the dimensions 'Journal concept' and 'Publishing scenario' that characterise a journal at a global level are first revisited. Then, the values associated with the remaining dimensions are disclosed in accordance with the four main phases of the scientific publishing cycle from the phase of

composition/submission to the phase of evaluation, and from the phase of dissemination to the phase of consumption.

The 'Journal concept' and the 'Publishing scenario'

Dimension 'Journal concept'. For both SSP and *Kairos*, a journal is a tool dedicated to designing a multimedia artefact through a collaborative process. As for JoVE, a journal is also conceived as a tool but a tool dedicated to producing in-house video articles. Regarding the dimension 'Journal concept', the value "experimental laboratory" and the value "service" can therefore be distinguished. "Tool" can be considered as a shared characteristic of a multimodal journal.

Dimension 'Publishing scenario'. The scientific publishing cycle, in the three multimodal journals under scrutiny, is approached in a sequential manner. First, it can be noticed that they all share the same characteristic of paying particular attention to the phase of composition of a multimedia artefact. The solutions diverge, however, in relation to the phase of evaluation. The major difference is that the review process, in JoVE, is conducted before the phase of composition (production). That is not the case for SSP and *Kairos*. Finally, the phase of consumption (commenting or rating a multimedia artefact) is not a high priority for all the three journals, with the relative exception of JoVE. For all these reasons, multimodal journals are not associated with common features shared by other types of digital journals such as rapid and immediate publication, open and transparent peer review. To sum up, regarding the dimension 'Publishing scenario', it can be noticed that the scientific publishing cycle in multimodal journals is maintained and reaffirmed as a linear process from composition/submission/evaluation (differently implemented) to dissemination and consumption. Two values are assigned for this dimension: "submission, evaluation, composition" and "submission, composition, evaluation".

The Dimensions Associated with The Phase of Composition/Submission

The dimensions 'Multimodal format', 'Multimodal integration strategy', 'Scientific purpose', 'Semiotic input', 'Research materials' and 'Support process'

are associated with the phase of composition/submission of a multimedia artefact.

- Dimension 'Multimodal format': all the three multimodal journals share a characteristic of publishing a scientific article based on a specific multimodal format that requires the use of a variety of semiotic resources beyond text and static visuals: a video format (JoVE), a "webtext" format (*Kairos*) and a multimedia format (SSP). The major difference found is that the format is predefined and stable in the case of JoVE (it does not differ significantly from one video article to another) whereas the article format (SSP) and in particular the webtext format in Kairos is experimental and, for this reason, re-invented each time. Consequently, the dimension 'Multimodal format' is assigned two values "Predetermined format" and "Experimental format"
- Dimension 'Multimodal integration strategy': all the three multimodal journals rely on a multimodal integration strategy deployed at the article level. Three main multimodal integration strategies have been defined and discussed at length. The journal *Kairos* is representative of a trans-modal integration strategy, *JoVE* of an inter-modal integration strategy and *Southern Spaces* of an intra-modal integration strategy. These three integration strategies represent the spectrum of values associated with the dimension 'Multimodal integration strategy' – another shared characteristic of multimodal journals
- Dimension 'Scientific purpose': all the three multimodal journals encourage and, at the same time, force contributors to make use of a variety of semiotic resources for scientific purposes. In other words, they disseminate multimedia artefacts that serve a scientific purpose: a video article (*JoVE*) is a scientific protocol intended to be reproduced. A webtext (*Kairos*) is a scientific narrative intended to be explored. An article "incorporating multimedia" (SSP) is dedicated to "advancing a critical argument" and exploring "new ways of presenting and organising research" in order to change the representation of a topic. Three values can be inferred from this: "reproducing an experiment", "advancing a scholarly argument" and "producing a multimedia research report"
- Dimension 'Semiotic input'. Kairos and Southern Spaces do not *a priori* limit the accepted semiotic resources contained in a submission in contrast to JoVE

that requires contributors to make use of written words and static visuals. This being said all the three multimodal journals share the characteristic of evaluating first a submission that is not a complete contribution that has to be accepted (then reviewed and revised) or rejected. They differ, though, as regards the semiotic input: contributors are expected to provide a "digital project" in the case of SSP and a "project" in the case of *Kairos*. This submitted multimedia object constitutes a first version of the multimedia artefact that will be eventually published. In contrast to *Kairos* and *Southern Spaces*, JoVE requires contributors a more formal text-based "manuscript" – that is a written proposal – describing a future video article. These two values – "multimedia object", "written proposal" represent the "spectrum of 'possible' of the dimension 'Semiotic input'.

- Dimension 'Support process': all the three multimodal journals are based on a collaborative process. They offer a support process to help less experienced contributors to respond the challenge of composing a multimedia artefact. There is however a major variation among multimodal journals depending how a multimedia artefact is produced: through a "prescriptive approach" or through a "non-directive approach". In the former case, the activity "designing a multimedia artefact" is a protocol to be rigorously followed (JoVE) with a production process carried out by a dedicated in-house staff (the researcher is not in charge of filming and editing the produced video). In the latter case, contributors are fully involved in every stage of the phase of composition (Kairos, SSP): designing a multimedia artefact is, in this last case, an exploration, a collaborative mentoring process. From this perspective, two values are associated with the dimension 'Support process': "mentoring a process (board members)" and "delivering a product (multimedia professionals)".
- The dimension 'Research materials'. Regarding this dimension, JoVE mentions research materials that will appear visually in a video article and SSP mentions "textual, archival, and ethnographic data" that are used in an "article". In contrast to the previous two journals, *Kairos* does not make totally clear which research materials might be incorporated in a webtext. Overall, the potential to document each main step of a research project, including the

empirical and the analytical phases does not seem to be used to its full extent in all the three multimodal journals. Two values are nevertheless assigned to this dimension: "multimedia data" and "multimedia research materials" – that is all the semiotic resources accumulated as well as all the multimedia artefacts generated during the phases of the research process prior to the phase of composition/submission.

The Dimensions Associated with The Phase of Evaluation

Two dimensions are associated with the phase of evaluation of a multimedia artefact: the dimensions 'Review system' and 'Publishing conduct'

- Dimension 'Review system'. In all the three multimodal journals, a review system is intended to evaluate the scientific content of a multimedia artefact. The proposed solutions differ concerning the summative and/or formative assessment of the quality of its design and the use made of a variety of semiotic resources. In contrast to *Kairos* and *Southern Spaces*, JoVE evaluated the relevance of the submitted written proposal and does not evaluate the "scientificness" of the produced video article as a whole. Based on the information transcribed in the previous section, the dimension 'Review process' (a summative assessment of a multimedia artefact) is associated with four values: "overall presentation and quality of design", "text only", "scientific rigor and relevance" and "usability". Regarding the semiotic resources, the value "text only" is added.
- Dimension 'Publishing conduct'. In all the three multimodal journals, ethics and more generally publishing regarding the use of audio-visual techniques or to reuse of copyrighted semiotic resources are under the responsibility of authors submitting a contribution if some guidelines exist (*Kairos* especially as regards fair use). However no experts in charge of verifying these aspects are apparently included in editorial boards, for instance. Two values are associated with this dimension: "Statement of copyright" and "Ethics statement"

Two dimensions are associated with the phase of dissemination of a multimedia artefact: 'Archiving policy' and 'Registration mechanism'

- The dimension 'Archiving policy' is about storing, preserving and maintaining multimedia artefacts over time in accordance with the principle of accessibility of scientific information. Archiving policy is not fully explicit in all the three multimodal journals. A "default" solution consists of archiving multimedia artefacts on the website. Based on available information, two values are associated with the dimension 'Archiving policy': "website" and "digital library".
- The dimension 'Registration mechanism' is associated with the value "DOI" (JoVE). Specific mechanisms for certifying a publishing multimedia artefact as a whole or each (and sometimes relatively independent) of its components cannot be found. Existing solutions seem to be lacking regarding this solution.

Finally, two dimensions are related to the consumption phase of a multimedia artefact: "

- Dimension 'Publishing model'. All the three multimodal journals rely on existing solutions regarding this aspect: open access versus subscription-based. No specific model seems to emerge. Three values are assigned to this dimension: "open access", "author-pay model" and "subscription-based journal"
- Dimension 'Mediated object'. On the basis of available information, only the value "Comment" is associated with this dimension.

The following summary table (see Table 12) gives an overview of the spectrum of values associated with each dimension. These values are derived from the previous discussion. The pairing between "dimensions" and "values" constitutes the morphological field 'Multimodal scientific publishing'.

DIMENSIONS vs. VALUES				
Journal Concept	An experimental laboratory	A service		
Publishing Scenario	Submission, Evaluation, Composition	Submission, Composition, Evaluation		
Multimodal Format	Experimental format	Predetermined format		
Multimodal Integration Strategy	Intra-modal strategy	Inter-modal strategy	Trans-modal strategy	
Scientific Purpose	Producing a multimedia research report	Reproducing an experiment	Advancing a scholarly argument	
Semiotic Input	A multimedia object	A written proposal		
Research Materials	Multimedia data recordings	Multimedia research materials		
Support Process	Mentoring a process (board members)	Delivering a product (multimedia professionals)		
Review System	Overall presentation & quality of design	Text only	Scientific rigor and relevance	Usability
Publishing conduct	Statement of copyright	Ethics statement		
Archiving Policy	Digital library	Website		
Registration Mechanism	DOI			
Publishing Model	Subscription-based journal	Author-pay model	Open access	
Mediated Object	Comment			

Table 12: The Morphological Field 'Multimodal Scientific Publishing'

In this second step of the synthesis phase, a solution space is inferred from the morphological field 'Multimodal scientific publishing'. This is done because the number of configurations possible for the resulted morphological field comprising of 14 dimensions and the values assigned for each dimension is not manageable (Table 12). In other words, it is impossible to analyse each of the (2*2*2*3*3*2*2*2*4*2*2*1*3*1=) 27,648 potential solutions contained in the field. In line with GMA, to reduce this number, a next phase consists in comparing all the values with one another, pair-wise: "As each pair of conditions [values] is examined, a judgment is made as to whether – or to what extent – the pair can coexist, i.e. represent a consistent relationship (Ritchey 2011:13). The relationships between values can be assessed from a logical viewpoint or from an empirical viewpoint:

> There are two principal types of inconsistencies involved here: purely logical contradictions (i.e. those based on the nature of the concepts involved); and empirical constraints (i.e. relationships judged be highly improbable or implausible on empirical grounds) (Ritchey 2011:14).

It is not possible, in the context of this work, to generate the complete "cross-consistency matrix" (Ritchey 2011:13) regarding the morphological field 'Multimodal scientific publishing'. It is sufficient to give but one example to illustrate however the general principle. In comparing the value 'service' from the dimension 'Journal concept' with the value 'mentoring a process' from the dimension 'support process', it can be argued that these two values are contradictory (a service is dedicated to delivering a ready-made product), even if they are not theoretically totally impossible to associate in a multimodal journal dedicated to offer the possibility to learn multimodal composing through a collaborative mentoring process. Consequently, if the solution 'service' versus 'mentoring a process' is rejected, it means that the workable configurations in the solution space are already more than halved (1*2*2*3*3*2*2*2*4*2*2*1*3*1 = 13,824) in comparison to the initial number of configurations. Thus, if the same

method is applied for another two dimensions, the solution space will comprise of a decreasing number of potential configurations (still to be evaluated). Ritchey notes that "a morphological field involving as many as 100,000 formal configurations can require no more than few hundred pair-wise consistency" (Ritchey 2011 14).

Coming back to the morphological space 'Multimodal scientific publishing' derived from the analysis phase of the four selected journals, a "provisional" solution space can be built based on the primary dimensions of a multimodal scientific journals. The primary interrelated dimensions give an overview of the main characteristics shared by existing multimodal journals. They provide an answer to the second and third research question posed in this work, concerning, first, the editorial policy applied in multimodal journals and, second, the scientific publishing cycle.

Following empirical observations, five primary dimensions have been identified in the context of this second of analysis. They are all associated with the composition/submission phase of the scientific publishing cycle with the exception of the dimension 'Review system' associated with the phase of evaluation:

- The dimension 'Multimodal integration strategy'. A multimodal integration strategy is implemented, in multimodal journals, at the article level.
- The dimension 'Multimodal format'. Multimodal journals promote specific multimodal formats. They require using semiotic resources beyond written words and static visuals; this in accordance with these promoted multimodal formats.
- The dimension 'Scientific purpose'. Multimodal journals approach semiotic resources as means for meaning making in the context of scientific publishing. Semiotic resources are not incorporated in a scientific article for illustrative purpose only.
- The dimension 'Review system'. The review system in multimodal journals is dedicated to assess the scientific quality of a multimodal artefact and the quality of its design as well.

- The dimension 'Support process'. Multimodal journals do not only encourage contributors to submit a multimodal artefact but also help to design the published multimedia artefact.

In contrast to these primary dimensions, other dimensions, such as 'Publishing conduct', 'Archiving policy', 'Registration mechanism', 'Publishing model' and 'Mediated object' are not specific to multimodal approaches to scientific publishing. As empirical solutions, the values associated with these secondary dimensions can also be found in other types of digital scientific journals. This "provisional" solution space 'Multimodal scientific publishing' comprises of 144 (2*3*3*2*4) possible configurations that can be further discussed, assessed and refined.

5. Conceptual Toolkit for Launching a Multimodal Journal

We have seen in the first two chapters that the encounter of digital multimodality and scientific publishing is not straightforward and that it raises a number of technical, cultural and systemic issues. There are nevertheless a few online scientific journals today that are designed to support multimodal publishing and dissemination of semiotic resources. They indicate possible ways how to solve the equation placed at the core of this work and they provide a range of empirical options for multimodal scientific publishing (Chapter 4). Based on the findings of this study, this chapter is intended to build a conceptual toolkit that allows systematic investigation of existing scientific journals or other existing scientific publishing environments disseminating multimedia artefacts. This conceptual toolkit, associated with GMA, is also aimed to help future project implementation and to help mapping and visualising a journal concept and all its dimensions during the conception phase of a project. To this end, the first section of this chapter gather all the conceptual and empirical elements discussed in the previous chapters into a whole that is conceived as an activity system (5.1.). This process of synthesising information is then transformed into a conceptual toolkit that can be used for the analysis of a scientific publishing environment based on a multimodal approach to scientific publishing (5.2.).

5.1. The Activity System 'Multimodal Journal'

The first sections of this chapter are dedicated to putting the different notions discussed in the previous chapters into perspective by locating them in the integrative model of second-generation activity theory (Engeström). A multimodal scientific journal can be framed by activity theory and defined as "object-oriented and artefact-mediated collective activity system" (Engeström 1987:6). The most important outcome of this system is new scientific knowledge (see 4.1). This outcome is achieved through the completion of four sets of activities (composing, evaluating, disseminating and consuming a multimedia artefact) linked to the four basic phases of the scientific publishing cycle.

An activity system is described by means of "six core components" (Foot 2014:5) that interact with each other. The first three components are the components 'Subject', 'Object' and 'Tool':

> The tool(s) [are] employed by the subject to act on the focal object or pursue the desired outcome. Tools can be either material or conceptual. Language, protocols, scientific methods and models, and other forms of cultural artifacts are just as much tools as are hammers, computers, and phones (Foot 2014:5-6).

The last three components 'Rules', 'Community' and 'Division of labour' are defined as follows.

> The fourth component in an activity system, the community ... consists of the people who share with the subject an interest in and involvement with the same object. ... Relations between the subject and the community are mediated by the last two components: a) the rules that regulate the subject's actions toward an object, and relations with other participants in the activity; and b) the division of labor, understood as what is being done by whom toward the object (Foot 2014:5-6).

An activity system with its six components, at a second level, is subdivided into the four subsystems of production, distribution, consumption and exchange. These four subsystems echo the four main phases of the scientific publishing cycle: a) 'Production' located at the intersection of 'Subject', 'Tool' and 'Object' is related to the phase of composition/submission of an article – a multimedia artefact, b) 'Exchange' reuniting 'Rules', 'Subject' and 'Community' is related to the phase of evaluation, c) 'Consumption' reuniting the components 'Community', 'Subject' and 'Object' is logically related to the phase of consumption. Finally d) 'Distribution' at the intersection of 'Object', 'Community' and 'Division of labor' is related to the phase of dissemination.

In the following, each component of the activity system is introduced one after the other in relation to the dimensions of a scientific journal and in relation to the dimensions included in the morphological field 'Multimodal scientific publishing' identified by single quotation marks (see 4.3.3). The activity system is described

in relation to a multimodal (scientific) journal but can be extended to other publishing environments intended to implement a multimodal approach to scientific publishing.

The Components 'Subject', 'Tool' and 'Object'

The first three components of the activity system 'Multimodal journal' are the component 'Subject' – the author or group of co-authors, the component 'Tool' or the publishing platform and the component 'Object' – the different scientific articles type or multimedia artefacts produced by a multimodal journal. These first three components constitute together the subsystem 'Production' or 'Composition/submission'. It is "generally regarded as the most important" (Fitzsimons 2003:48).

- The component 'Subject' is commonly defined as "the individual or any group engaged in the activity" (Fitzsimons 2003:48). The 'Subject' of the activity system 'Multimodal journal' is the researcher or a group of researchers that submit the 'Semiotic input' and possibly all the 'Research materials' that are transformed into a published multimedia artefact. The component 'Subject' is also paired here with two other particularly important actors or group of actors engaged in the production process of a scientific multimedia artefact: the editorial board members in charge of a multimodal journal and providing resources and support (dimension 'Support process'), the multimedia professionals or the multimedia support team in charge of helping to design a multimedia artefact. The same actors can be involved in different roles (e.g. reviewers and support) taking place at different phases of the 'Publishing scenario'. It is important to note that if a user is given the possibility to comment and to edit a multimedia artefact (dimension 'Mediated object'), s/he could be considered as a co-author and therefore could be associated with the component 'Subject'.
- The component 'Tool' of the activity system 'Multimodal journal' is paired with the publishing platform and all or authoring tools used to transform the 'Semiotic input' (a submission) into a multimedia artefact. The component 'Tool' is also paired with all the 'semiotic resources' that the actors involved in

the activity system 'Multimodal journal' used to accomplish the activity 'publishing a multimedia artefact. The functions of the publishing platform are described in the 'Journal concept' and in the 'Publishing scenario' (the successive phases of composition/submission, evaluation, dissemination and consumption of a multimedia artefact).

- The component 'object' is at the same time the driving idea and the final output of the activity system 'Multimodal journal' – that is "something anticipated, projected, transformed, and achieved" (Foot and Groleau 2011:n.pag.). As the final output, the component 'object' comprises of all the different types of 'multimedia artefacts' (or article types) published in a multimodal journal. It can be noted that the published multimedia artefact can be considered as a finished object or as an object that can be re-use in future multimedia artefacts. In this last case, it is approached again as semiotic resources and then placed under 'Tool'.

The components 'Community', 'Division of labor'

The next three components – 'Rules', 'Community' and 'Division of labor' – of the activity system 'Multimodal journal' are now introduced. They allow describing the three remaining subsystems of 'Evaluation' (reuniting the components 'Subject', 'Rules' and 'Community'), 'Consumption' (reuniting the components 'Subject', 'Object' and 'Community') and 'Dissemination' (reuniting the components 'Object', 'Community' and 'Division of labor') of a multimodal journal.

- The component 'Community' in the activity system 'Multimodal journal' is about "people and groups whose knowledge, interests, stakes, and goals shape the activity" (Kain and Wardle 2014:277) – that is the scientific community approached as a whole or, more particularly, a scientific discipline community that is the target audience of a multimodal scientific journal. In other words, a specific history perpetuated by representatives (i.e. reviewers) of a specific discipline, specific interests of funders and publishers, requirements of library and bibliographic services, and expectations of practitioners – all of them contribute to influence and shape the activity "publishing a multimedia

artefact" (which semiotic resources are supposed to be used, why, and how) in a more or less controlled manner. The component 'Community' is paired, in the context of the activity system 'Multimodal journal' with two categories of people. First, the readers/users who search for and read/experience a scientific articles/multimedia artefact. Second, the reviewers in charge of evaluating a multimedia artefact, acting as representative of the scientific community, and acting as representatives of the scientific community or the scientific discipline community. It is worth noting that a reviewer could also be considered, in some cases, as a subject, when s/he is directly involved in a collaborative process of composing a multimedia artefact.

- The component 'Division of labor' is "understood as what is being done by whom toward the object (Foot 2014:6). The component 'Division of labor' in the activity system 'Multimodal journal' refers to the set of roles (who is in charge of what and when) and responsibilities (who is responsible for what and who controls what) assigned to the participants engaged in the activity 'publishing a multimedia artefact' play. This set of attributions is particularly made explicit in the 'Publishing scenario' that describes the sequential order of a chain of operations that leads to transform all the semiotic input and the multimedia research materials submitted to a journal into a peer-reviewed multimedia artefact. In the context of an activity system 'Multimodal journal', the division of labor and the related 'publishing scenario' can be extended to different tasks linked to the research process prior to submission.

The component 'Rules'

The component 'Rules' is pivotal in the activity system 'Multimodal journal'. The rules – that is the editorial policy of a multimodal journal "regulates the activities of the system" (Fitzsimons 2003:49). There are four categories of rules in a scientific journal. This is also the case in a multimodal journal. These rules have been described in the previous chapters of this work in terms of 14 dimensions (see 4.3.2) and in relation to the four basic phases of the scientific publishing cycle.

- The rules concerning the phase of composition/submission are associated with the subsystem 'Production' in the activity system 'Multimodal journal'. They are specifically related to the opportunities offered and the challenges posed by multimodal composing and publishing (see Chapter 2). This set of rules is paired here with the dimensions 'Multimodal format', 'Multimodal integration strategy', and 'Support process'.
- The three other categories of rules are intended especially to meet the formal requirements of scientific publishing in journals. The rules concerning the phase of evaluation, and associated with the subsystem 'Exchange' in the activity system 'Multimodal journal', are paired with the dimension 'Review process' and 'Publishing conduct'. The rules related to the phase of dissemination (the subsystem 'Distribution') are paired with the dimensions 'Archiving policy' and 'Registration mechanism'. Finally the phase of consumption and the associated subsystem 'Consumption' are paired with the dimensions 'Mediated object' and 'Publishing model'.

It is possible to understand through the following two definitions how the various components of the activity system 'Multimodal journal' dynamically interact. A multimodal scientific journal can be defined as a registered publication run by an editorial board and directed to a target audience ('Community') – a publishing platform and an authoring tool ('Tool') dedicated to produce, evaluate and disseminate in a determined sequential order ('Division of labor') multimedia artefacts ('Objects') validated as compliant scientific articles through a review process ('Rules') and made up of a variety of semiotic resources – initially submitted by an author or a group of authors ('Subject') – meaningfully assembled to construct a scholarly argument. Similarly, it can be said that a multimodal journal is a tool that produces and makes new knowledge available online ('Production') in the form of peer-reviewed ('Exchange') scientific articles based on multimodal formats ('Distribution') that are experienced – reflected upon, commented, shared and rated, etc. – by various categories of users ('Consumption').

The last dimension to be integrated in the activity system 'Multimodal journal' is about the fact that an activity system is not fixed but it changes and evolves over time on the one hand and that an activity system is historically conditioned on the other hand: it "comes into being because of practices that have a history. At any point that we begin to study how a system works, we need to consider how it came to function in a particular way" (Kain and Wardle 2014:276). This last dimension is associated in the context of an activity system 'Multimodal journal' as the publishing paradigm on which the system is based.

A publishing paradigm is understood here a) as a 'background' that connects the four subsystems and the six components of an activity system and b) as a claim or an attitude that is enacted through various practices, rules and roles taking place in a community. It can be argued that a publishing paradigm is expressed by specific configurations between the six components of an activity system. A change of paradigm means that these configurations are modified, not only partially, but also in a way that affects all relations between all components. The result is a new set of opportunities (a qualitative shift) but also a new set of constraints (an increasing complexity).

At the present moment, three main "web publishing paradigms" (Guay 1995:n.pag.) coexist online with one another: the print, digital and multimodal paradigm. The result of this coexistence is contradictory and has been contradictory from the start: the three key paradigms compete or cooperate with each other, depending on circumstances.

- The print paradigm "is the repurposing of the traditional linear, hierarchical print format … a second trait of the print paradigm is that the information is limited to text and still images, identical to what you would find in a magazine or book" (Guay 1995:n.pag.). A large majority of online journals is still based on the print paradigm and disseminates articles in PDF format.
- The second publishing paradigm or "the hypertext paradigm is the key foundational paradigm for the Web and is what gives the Web its the power and potential. Its nonlinear, nonhierarchical, borderless. Its object-oriented nature has profound implications for both the Internet and society" (Guay 1995: n.pag.). More and more journals follow this second publishing paradigm.

In this case, the scientific article is delivered and displayed in a HTML format. Many clickable links to internal (within the website of the journal) or external resources are included as well as various functionalities (such as "contact", "share", "like", "comment", "metrics" etc.) are integrated.

- The third paradigm - "the multimedia paradigm ... is a powerful paradigm, for it provides a multisensory experience, engaging us and communicating to us in a way that text alone cannot" (Guay 1995:n.pag.). A few scientific journals are currently based on what is defined in this work as the (digital) multimodal publishing paradigm. Guay provides a possible explanation for this situation:

> When it is fused with augmenting paradigms such as hypertext and interactivity [i.e. the hypertext paradigm] to form interactive hypermedia, and used effectively, it is powerful paradigm for communicating complex information. However, if fused to a limiting paradigm, such as the print paradigm, it will fall short of its potential. Even worse, if multimedia is used with no thought as to the reasons why it is being used, or has poor layout or content it can result in a pointless aesthetic fiasco… (Guay 1995:n.pag.)

To sum up, the multimodal publishing paradigm enacted by an activity system 'Multimodal journal' can be defined as a qualitative shift resulting in a change in the way knowledge is generated (multimodal formats), evaluated, disseminated, shared (scientific multimedia artefacts) and consumed (a multimedia artefact is not intended to be read but explored or experienced).

In what follows, the complete conceptual toolkit aimed to provide a support during the conceptual design phase of a project for creating a multimodal journal is summarised.

Conceptual Toolkit

In Figure 31, the six main components of the activity system 'Multimodal journal' ('Subject', 'Tool', 'Object', 'Division of labor', 'Community' and 'Rules') are represented by various rectangles. The most important outcomes (the red arrow on the right-hand side) of a multimodal journal are, like it is the case for other scientific journals, generating "new scientific knowledge" and contributing to "a

better quality of life" Björk (2007:12). These two outcomes should not be confused with the objects or outputs of the activity system: various types of multimedia artefacts. The lively discussions around "publish or perish" taking place regularly in the scientific community, in our understanding, is one expression of an activity system in which outcomes and outputs tend to converge and merge, or to be confused.

The second layer of the conceptual toolkit is composed of four interrelated triangles. In the original framework of activity theory (Engeström), the four triangles are introduced as the four subsystems of production, exchange, distribution and consumption. These triangles, associated with the multimodal publishing paradigm in the background, connect the main components of the activity system 'Multimodal journal'.

The four triangles of the activity system 'Multimodal journal' include the dimensions that have been summarised in the morphological field 'Multimodal scientific publishing' (see 4.3.2) and in relation to the component 'Rules' of the activity system 'Multimodal journal'. These dimensions – the editorial policy of a multimodal journal or a set of rules "that people adhere to while engaging in the activity" publishing a multimedia artefact (Kain and Wardle 2014:277) – are represented in bold capital letters in Figure 31. They have to be taken into account, discussed and negotiated, when dealing with the creation of a multimodal journal. In Figure 31, for clarity purposes, the dimension 'Journal concept' is placed in the rectangle associated with the component 'Rules', and the dimension 'Publishing scenario' in the rectangle associated with the component "Division of labor".

The following short sample case study is intended to test the previously described conceptual toolkit (see Figure 31). It provides an overview over a concrete example of a publishing environment that is not strictly speaking a scientific journal but that can also be approached as a tool that takes advantage of possibilities afforded by digitality. It illustrates how some of the dimensions of a multimodal approach to scientific publishing can be put into practice. In a nutshell, this example should be understood as the enactment of a particular (digital) multimodal publishing paradigm for scientific purposes.

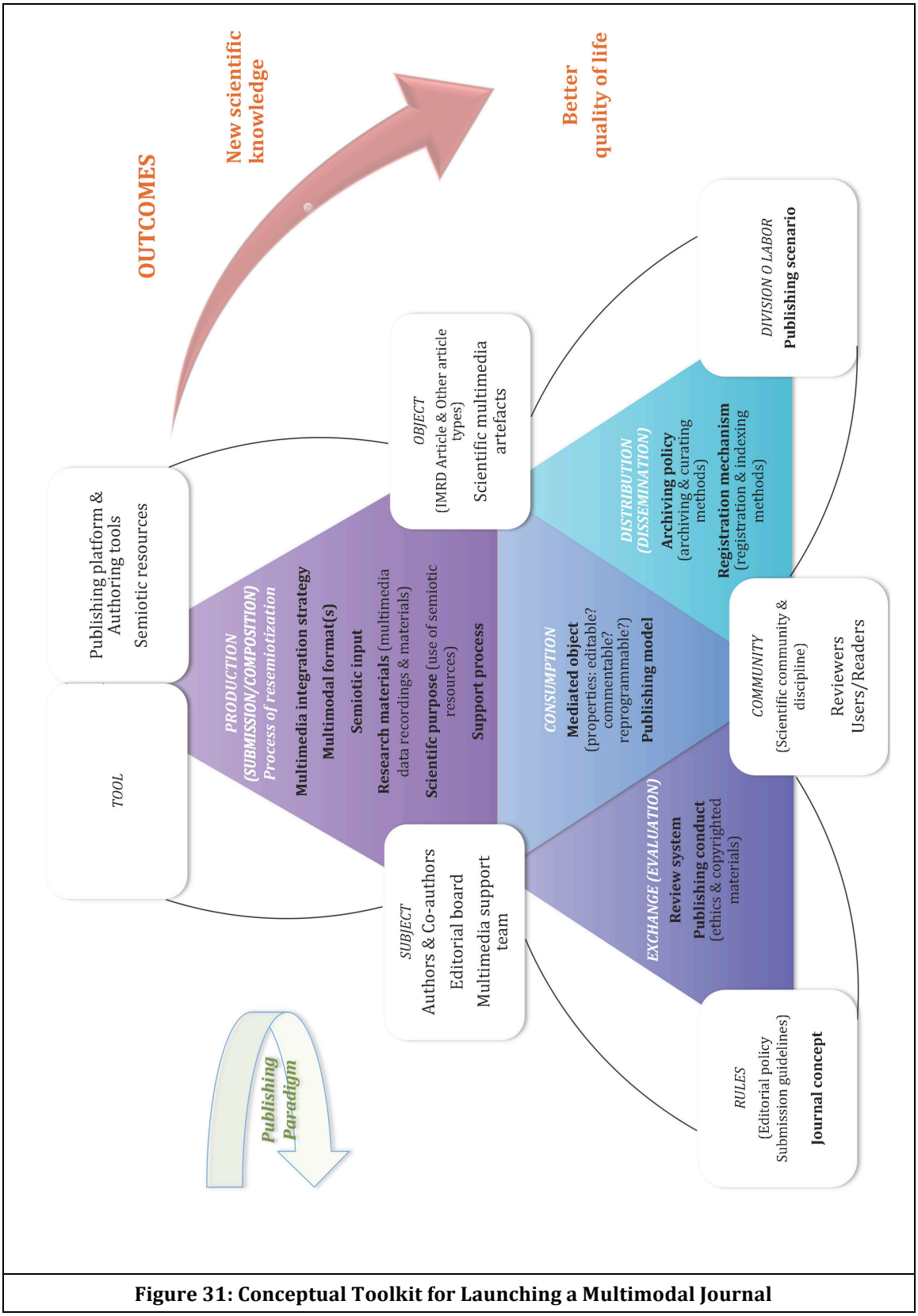


Figure 31: Conceptual Toolkit for Launching a Multimodal Journal

5.2. Practical Application: the AIME Project

The AIME project [An Inquiry into the Modes of Existence] (see Figure 32), under the responsibility of Latour, is about investigating, describing and enacting "the modes of existences" (AIME n.d.) shared in the world today. It is subtitled "how do we compose a common world" (AIME n.d.). The AIME project is an ongoing project dedicating to documenting online the three conventional phases of the research process: "do research, communicate and apply the results" (Björk 2007:12) (dimension 'Journal concept'). Consequently, the platform of the AIME project is not limited to disseminating research findings (dimension 'Publishing scenario').

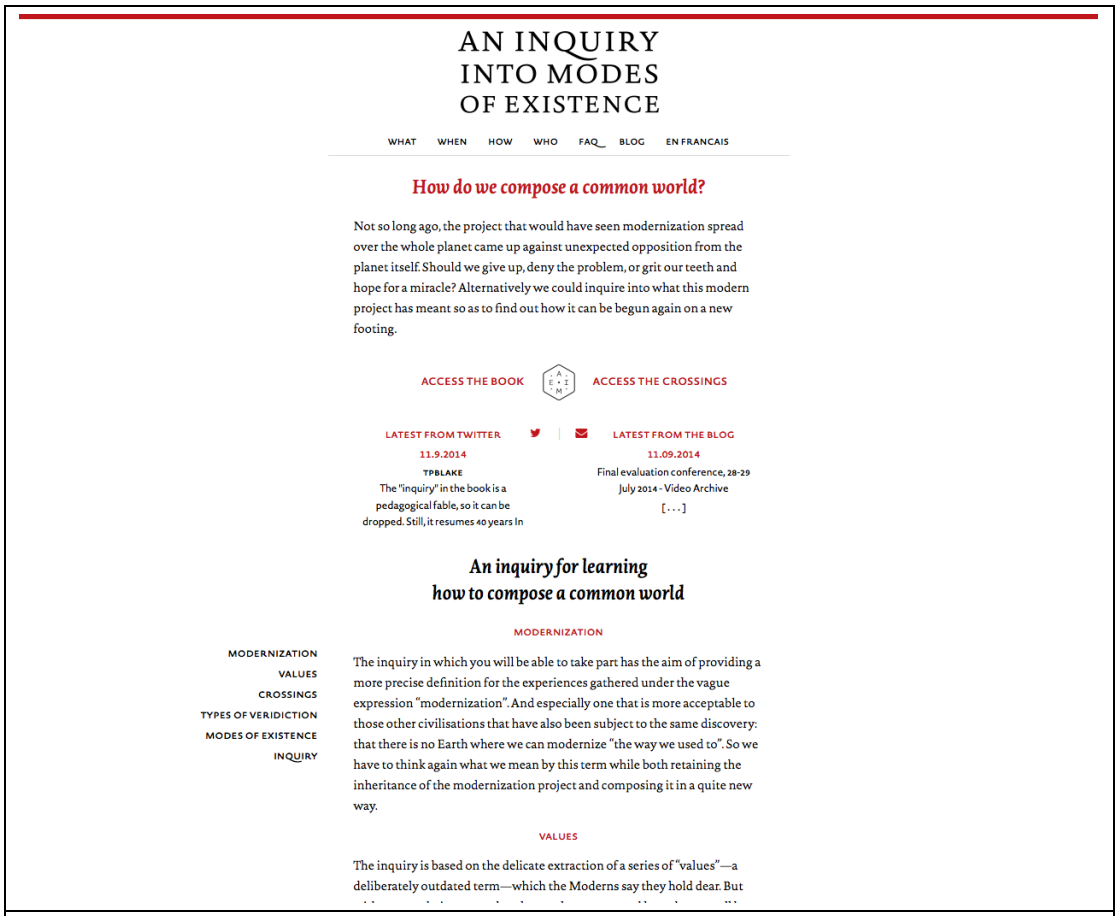


Figure 32: Homepage of The AIME Project (AIME n.d)

The AIME project promotes an online collaborative approach to research. This means that the distribution of traditional roles are changed that are assigned to a

researcher (a member of the "project team" or a "mediator"), a reader (a "co-researcher" or a "collaborator") and the informant in the field (a "contributor") (Components 'Division of labor' and 'Subject'). The informant is integrated in the research project as a reader and as a co-researcher. His role is not limited to the initial empirical phase. Similarly, the researcher is both a reader and a subject of his own work in-progress: he does not fully control the results being produced. Finally, the role of the reader is not limited to the consumption phase: as a reader acting as an informant, his/her comments are reintroduced in the phase of production as empirical data.

The research process designed by Latour and his team is made of three interrelated phases - the "stages: that of the readers, that of the co-researchers, and that of the negotiators" (AIME n.d.). The second phase is intended to switch from the classic "reading mode" to a collaborative work with readers becoming "co-researchers" (component 'Subject'):

> But we will very quickly notice that you will not just want to correct errors and comment on the statements made in the interim report, in other words offer a critique, but you will want to take up other questions as you formulate the problems in a quite different way (AIME n.d.) ...

A specific system of "veridiction" and validation of the generated knowledge occurring through the research process is initiated (dimension 'Review system'):

> The metaphor we use is that of diplomatic negotiations. This expression is often pejorative, but we take it very seriously because negotiations come into play when there is no common overarching principle that would allow for agreement. So the only solution is to set out as precisely as possible why the account given of such and such a value is shocking, admissible, compatible, or incompatible with some other account ... To launch such negotiations, the mediators will invite a certain number of contributors and co-researchers to face-to-face meetings (AIME n.d.).

The bilingual (English and French) "multimedia platform" (AIME Blog 2013b:n.pag.) of the AIME project is conceived, at the same time, as a blog, a

forum of discussion (section "discussions" under "blog"), an archive documenting the project (section "materials" under "blog"), as well as a publishing incubator intended to produce new knowledge (component 'Tool'):

> At the beginning of the site you will find an “augmented” book ... Why are we calling the digital book augmented? Because we have added three columns to it ... What are these columns? The first column is the glossary (v for vocabulary). ... The second column contains information on documentation (d). ... The third column is for contributions (c). This is a space for you to publish critiques, additional considerations and/or complementary or alternative documentation, based on your notes. Mediators will help you to find your way around and will moderate the contributions. Depending on the evolution of the site, your contributions may be transferred to the middle column.

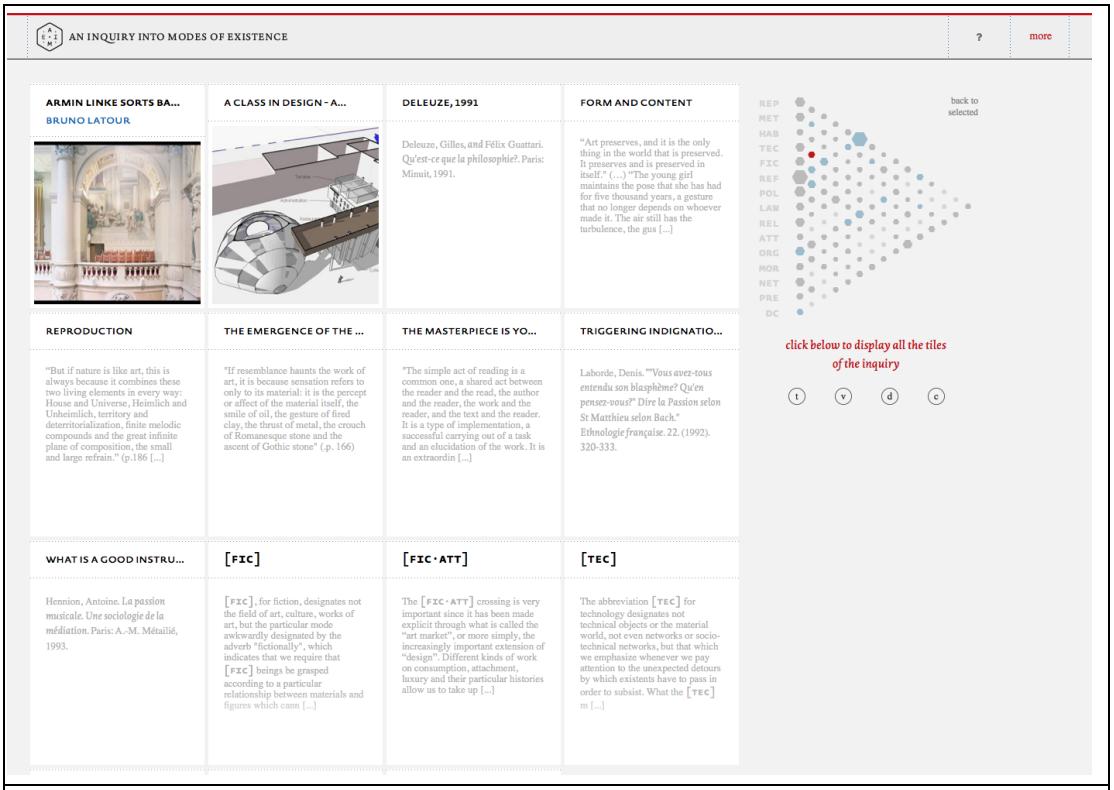


Figure 33: The Multimedia Artefact of The AIME Project– The Crossings (AIME n.d.)

The AIME project produces an in-progress multimedia artefact called "the Crossings" (see Figure 33), that is also used as a "database". It is an evolving, interactive multimedia artefact (component Object) assembling different semiotic resources (Component 'Tool') coming from different 'semiotic input',

'multimedia recording' and 'multimedia research materials'. It can be described as a whole made up of different, more or less independent, wholes-parts (dimension 'Multimodal format'). The use of various semiotic resources in the AIME project is associated with a 'scientific purpose':

> Our hope is to engage AIME in a dialogical and open-access format that will allow the scholarly community at large to think with the text through written response pieces, digital dialogues, and other multimedia formats (AIME Blog 2013a:n.pag.).

One of the keywords of the project AIME is the term "composition". This term is the umbrella term for describing the multimodal publishing paradigm of the AIME project. "Composition" is a new way to conceive and enact the relations between theory and practice; between process and product; between project and object; between paper and screen; between online and offline activities; between places and events:

> The aim, both ambitious and modest, will be to propose an alternative for the term “modernize”, one that is compatible with the expression “ecologize” and which we sum up with the term “composition”. Learning how to compose the common world, this is what is at stake (AIME n.d.).

To sum up, and even if some of these conclusions would require further study, the AIME project approached as an activity system ("a whole ecosystem"):

- Provides a publishing platform that is a "multilingual and multipurpose e-Infrastructure" (Borgman 2007:252). It could be noted that the publishing platform can be considered as a scientific artefact itself (Component 'Tool')
- Integrates various types of semiotic resources distributed in three main sections ("An inquiry into modes of existence", "the book", "the crossings"). Written words dominate especially in the main section ("An Inquiry into the mode of existence") and its linear display. The section called "The Crossings" integrates other types of semiotic resources (Component 'Tool')
- Produces and disseminates a scientific multimedia artefact based on a multimodal format named "The Crossings" (Figure 4.33). The multimedia artefact 'The Crossings' is based on some of the main characteristics of a

digital object such as editability (it is regularly updated), navigability, connectivity and interactivity. It is also comprised of different independent objects such as videos (component 'Object').

- Defines new roles and responsibilities (Component 'Division of labor') according to a publishing scenario that reconnects the different phases of the research process and the scientific publishing cycle.
- This redefinition of roles and collaboration is closely linked to concomitant changes in relation to the components 'Subject' ("contributors", "teams", "mediators", and "collaborators") and 'Community'.

As regards the component 'Rules', the AIME project is a "digital inquiry" (AIME n.d.). This "digital inquiry" revolves around a publishing paradigm ("composition") that permeates the subsystems of production, exchange, consumption and distribution. Consequently:

- The AIME project is based on a system of social validation and different "types of veridiction" (dimension 'Review system').
- Participating in the AIME project means assembling, communicating and disseminating multiple 'research materials' and 'semiotic input'.
- Is community-based and engages participants in a collaborative approach. That is to say that it generates knowledge through the interaction of participants with a tool-artefact (dimension 'Support process').
- Is based on a 'multimodal integration strategy' that approaches semiotic resources as means for meaning making (dimension 'Scientific purpose').

Finally, regarding the expected outcomes, the AIME project is aimed to produce new scientific knowledge about current modes of existence and to answer a question relating to a common future ("how do we compose a common world") (Outcomes).

Conclusion

The research undertaken places at its core an equation aimed to bring together two topics that are still rarely approached in conjunction: multimodality and scientific publishing. This equation (digital multimodality + scientific publishing) has been solved through different steps – theoretical and empirical. Chapters 2 and 3 situate the concern with this equation at the crossroads of four interdisciplinary research fields (the fields of composition studies and social semiotics, the fields of genre studies and information studies). These fields could be used as complementary sources that allow describing the emerging field of multimodal scientific publishing. Based on these theoretical perspectives, an empirical analysis was conducted, focusing first on 38 scientific journals disseminating semiotic resources, and second on three multimodal journals and one multimedia journal (chapter 4). Finally, in chapter 5, as an outcome of this analysis, a conceptual toolkit was developed, dedicating to help formulating guidelines for creating a multimodal journal.

Overall, the empirical part of the research covered only a relatively small number of journals. The reason for this limitation is that there are not yet many truly multimodal scientific journals compared to the abundance of journals delivering articles based on more conventional formats. Consequently, identifying appropriate multimodal scientific journals has proven to be one of the first main challenges during the process of completing this research (4.2). The reasons for this are many. First, *multimodal journal* is not an umbrella term identifying a well-defined category of journals as it is the case now for digital or electronic journals. Second, written words are still the dominant mode of communication regarding formal scientific publishing of research outcomes and this despite scientific visualisation (3.2.). Third, according to social semiotics, every event or product is by definition multimodal (2.2). This aspect contributes in a somewhat ironic way to obscure the fact that the research article published online remains largely unchanged in comparison to its traditional printed counterpart. Finally, multimodal publishing is more than just integrating a video,

a discussion forum, or some multimedia section into a journal. Rather, it involves a change of perspective and a change of practice inscribed at the heart of the research article itself. In other words, multimodal publishing lies in the fact that multimodal composition (2.1) – designing a multimedia artefact – is not equivalent to simply integrating multimedia content. Rather, it raises various issues questioning existing and well-established norms and standards historically associated with the scientific communication system (3.3.).

Some of these issues have been addressed through three research questions:

- RQ1. If multimedia integration is a necessary condition for multimodal publishing, which multimodal integration strategies underlie the dissemination of scientific multimedia artefacts in multimodal scientific journals?
- RQ2. If multimedia integration is not sufficient condition, which specific editorial policy is applied in multimodal scientific journals to enable publishing articles based on multimodal formats and to disseminate scientific multimedia artefacts that meet scientific standards and requirements?
- RQ3. Finally, if a multimodal scientific journal is dedicated to disseminating scientific multimedia artefacts, in what way and to what extent can it be argued that the conventional scientific publishing cycle (from composing/submitting to evaluating, and from disseminating to consuming), historically linked to the development of print technologies, is changed in multimodal scientific journals?

These research questions have been addressed through the analysis of current online scientific journals that give access to multimedia content.

R1. As response to the first research question, a typology of multimodal integration strategies has been devised. Three specific multimodal integration strategies could be evidenced in existing multimodal journals. These strategies have been called the intra-modal, inter-modal and trans-modal integration strategies. Each of them entails a specific orchestration of semiotic resources associated with a scientific purpose (see 4.2).

- The intra-modal integration strategy relies on a multimodal approach to scientific publishing that still considers written words as the dominant semiotic resource for meaning making. This approach means incorporating visual or other semiotic resources, used as "multimedia enhancements" (Treloar 1998:127) of a scientific argument, this in a scientific article still organised in a linear manner (see, for instances, different types of articles published in *Southern Spaces*).
- The inter-modal integration strategy is a strategy that tends to approach two main semiotic resources in combination. Each of these semiotic resources is assigned a scientific purpose. For instance a video, in JoVE, is made up of a video, conceived as a tutorial, dedicated to showing and reproducing an experiment and an article presenting the findings of a research.
- Finally, the trans-modal integration strategy is about making an argument through the design of specific multimedia artefacts, such as webtexts (*Kairos*) incorporating, associating and interconnecting multiple semiotic resources. Consequently, a scientific multimedia artefact based on a trans-modal integration strategy is an exploratory and experimental format that tends eventually to transform the established scientific article genres and narratives even if it complies with usual scientific standards and requirements.

R2. The second research question was answered by identifying core characteristics shared by multimodal journals (see 4.3).

- As already mentioned, a multimodal journal is based on a multimodal integration strategy implemented at the article level. This strategy is described in an editorial policy that explicitly invites contributors to submit projects that integrate semiotic resources beyond written words and static images or visuals. It follows that:
- A multimodal journal disseminates scientific multimedia artefacts that are, at the same time, scientific articles based on specific multimodal formats. In other words, a multimodal journal is a scientific journal that meets scientific requirements in terms of the scientific article genre and that promotes, at the same time, a specific combination of semiotic resources (a format) reflecting a scientific purpose (showing an experiment, designing an argument).

Accordingly, the scientific article genre can be basically defined as the sum of a multimodal format and the IMRaD structure.

- In a multimodal journal, the review system is intended to evaluate not only the scientific quality but also the quality of the design and the overall presentation and usability of a multimedia artefact. Besides an editorial staff with specific competences linked to multimedia, a multimodal journal requires reviewers with multiliteracy skills able to critically evaluate the relevance of the semiotic resources used in a multimedia artefact as well as the general structure of a scientific multimedia artefact.
- A multimodal journal is a journal that provides guidance and support during the production process. Due to the lack of standards concerning the design of a multimedia artefact in general and of a scientific multimedia artefact in particular, producing a multimedia artefact relies greatly on collaborative work. This support process is associated either with new roles and new actors (multimedia professionals) or with more traditional roles (reviewers, editors, authors, readers) that are adapted to meet specific requirements related to multimodal composing.
- A multimodal journal is based on a scientific publishing paradigm that influences, not only how a multimedia artefact is disseminated but also how a multimedia artefact is produced, evaluated and expected to be consumed.

R3. The answers provided to the third research question related to the scientific publishing cycle in a multimodal journal, can be summarised as follows (see 4.3).

- The four basic phases of the scientific publishing cycle (composition and submission, evaluation, dissemination and consumption) in a multimodal journal are globally maintained but adapted to new constraints resulting mainly from multimodal integration strategies.
- The phases of composition/submission and evaluation are given special attention. In contrast to more conventional online scientific journals, composing a multimedia artefact is fully integrated as part of the production process. Consequently, a submission to a multimodal journal is not a finished object (a "complete paper") to be evaluated, revised and copyedited according

formatting requirements but first a project to be designed in collaboration or produced in-house.

- The phase of evaluation has to combine a formative and summative assessment; the former in relation to the promoted multimodal format, the latter more classically in relation to scientific requirements and standards of scientific publishing. On the contrary, there is less focus on the phase of consumption (i.e. commenting and rating a multimedia artefact) in a multimodal journal (a multimedia artefact is expected to be experienced and explored rather than to be read, commented and rated) and on the phase of dissemination. However, this last point has to be attenuated. Appropriate archiving and curating methods as well as suitable registration and indexing methods that take into account the full complexity of a multimedia artefact seem to be lacking.
- Reinforced in contrast to other online journals based on open and transparent peer-review systems. Submitting, evaluating, and disseminating represent traditionally three successive stages, and this sequencing is also unavoidable in the case of a multimodal journal, whereas in the case of open access journals based on a transparent review system it is possible to perform these steps in parallel.
- Extended, to some extent, in order to include other phases of the research process prior to a submission. A multimedia artefact potentially integrates and includes different types of multimedia data recordings and multimedia research materials generated or processed at different steps of the research process. Multimodal journals enable to build new connections and relationships between the different phases of the research process and the scientific publishing cycle. Consequently, they do not focus only on the validative strand but also on the injunctive, apprehensive and interpretive strands related to the research process (see 4.1).

In analysing sustainable scientific journals based on main multimodal integration strategies, this work overall concludes that:

- A multimodal journal turns out to be simultaneously innovative (this is a tool that allows for experimentation of emergent scientific genres based on

multimodal formats) and conventional (this is a forum disseminating research findings and an archive dedicated to storing scientific articles). A multimodal journal as a solution of the equation – digital multimodality + scientific publishing – is a search for a balance between experimentations required to advance multimodal publishing and reproduction of age-old practices of scientific publishing required to respect academic standards.

- It is necessary to distinguish between online journals, multimedia journals and multimodal journals: an online journal is mainly based on a change in the way a scientific article is disseminated (e.g. the PDF format) and distributed – online rather than on paper (see 5.1); a multimedia journal opens up the principal possibility to display other media than text and still image, mainly for communicative and promotional purposes, while a multimodal journal is based on a multimodal publishing paradigm that permeates the phases of composition/submission, evaluation, dissemination and consumption. In other words, a multimodal scientific journal is based on a multimodal publishing paradigm closely related to a scientific purpose that is enacted in and through a multimodal format meeting the scientific standards of content and structure established in a field.
- The use of multiple semiotic resources remains to be promoted within the scientific community as effective and powerful means for advancing and enacting a scientific argument. Encouraging and inviting contributors to submit a multimedia artefact is not a sufficient incentive.
- Multimodal journals, in conjunction to other (digital) publishing environments, play an active part in restructuring the dominant model of formal scientific publishing that is still predominantly based on print technologies. They contribute indirectly to transforming the research process as a whole.
- Scientific research is increasingly multi- and interdisciplinary. Multimodal scientific publishing has the potential to represent a powerful support for research and to help dealing with complex research topics that are hard to be conveyed by means of written words or traditional ways of publishing.

These findings were obtained using, first, a content analysis of the editorial policy of a sample of online scientific journals providing multimedia content to user, and second, comparative case studies based on a method called GMA. Two critical questions may be raised concerning the chosen methodology. The first relating to the representativity of the selected sample and the second to the morphological field and the 'provisional' solution space generated through the synthesis phase of GMA. As regards representativity, the fact that most of the 38 journals included in the first sample result from three quantitative studies, each based on a huge sample, help supporting the argument that the selected sample is representative of current multimodal approaches to scientific publishing in scientific journals. It can therefore be assumed that the proposed typology of multimodal integration strategies gives a fairly complete picture of the actual situation. As regards the second issue, the obtained morphological field is built mainly on information found on the website of four journals. This phase of the research process was preceded by personal communications with three among four editors of journals included in this second sample. Consequently, the generated morphological field describing the primary and second dimensions of multimodal journals can therefore be considered representative of the range of existing publishing paradigms and the spectrum of values assigned for each dimension as accurate and comprehensive – and this, despite the fact that editors did not audit the validity of the resulting morphological field.

Another critical question may be raised concerning the choice to approach scientific journals without distinguishing between research fields and disciplines. As already mentioned, multimodal publishing is so far promoted and enacted only in a minority of scientific journals. In consequence, such a distinction could not practically be made. An explanation can also be derived from a historical perspective: the early electronic journals were frequently based on personal initiatives of scholars linked to a specific discipline before becoming a common practice shared by all disciplines. It is likely that the same kind of development is now occurring in the case of multimodal journals: a) a personal initiative or proposal is b) tested in the discipline the initiator belongs to, before it is transferred to other fields. The question of social innovation in regards to scientific publishing in relation to scientific domains remains to be studied,

however. In particular, the degree to which the disciplinary tradition is critical for embracing novel multimodal approach to scientific publishing is unclear.

In sum, the importance of this work is threefold. First, it contributes to defining multimodal scientific publishing as an emerging field situated at the intersection of four interdisciplinary research areas: composition studies, semiotics social, genre studies and information studies (chapter 2 and 3). These areas taken together allow highlighting issues that are usually not fully interconnected. For instance, the field of information studies gives an opportunity to approach multimodal publishing through topics such as the registration mechanism and the archiving practices that are not primary concerns in the field of semiotics social or composition studies. In a complementary manner, the field of social semiotics indicates that multimodal publishing cannot be reduced to the technical requirements of a platform. Finally, the field of composition studies shows that multimodal publishing while closely linked to interactivity, hypertextuality and multimedia integration, is more than these important digital characteristics. Overall, multimodal scientific publishing brings multimodal approaches from across these four fields together into a unified project of research and practice.

Second, this work contributes to create visibility for novel approaches to scientific publishing that results in promoting a variety of scientific communication styles that are not fully exploited in more conventional scientific journals publishing text-based articles. At the same time, multimodal composing is time consuming and requires abilities that are not yet fully developed. These are inhibiting factors preventing the use of multimodal approaches to publishing at a larger scale especially in scientific journals. From the viewpoint of multimodality, the distinction between intra-, inter- and trans-modality contributes to highlighting different complementary instances implicitly included in the notion of multimodality.

Some of the major implications of this exploratory study can be described in relation to the roles and functions of a scientific journal. Two perspectives seem to contradict each other in the equation 'digital multimodality + scientific publishing'. In light of the 'scientific publishing' term of the equation, a journal is

a channel for communicating, validating and archiving research findings in a formal way. If now the "digital multimodality" term of the equation is considered, multimodality means experimentation, first and foremost. No standards or norms have been established so far, multimodal practices are still being developed. The present work shows how a few journals overcome this contradiction between innovation and convention. In doing so, they offer components of a vision of how multimodal journals could be conceived as publishing incubators that are dedicated to support and accompany scientific projects from their inception to their implementation. The role of a journal is then no longer restricted to publishing articles and communicating research findings but it can be extended to each step of the research process. The existing multimodal journals also offer components of a vision of a journal conceived as a multidisciplinary and multipurpose platform combining different publishing environments (a journal, a blog, a database, a repository etc.) and dedicated to different publishing activities (creating and disseminating not only articles, but also various types of pre- and post-publications). In this expanded perspective a journal can be variously understood as a tool, an archive, a forum, or even as an event. Overall, the implications of this study indicate the need for three changes of perspective regarding 1) scientific publishing: from scientific publishing based on papers and articles to scientific publishing based on scientific multimedia artefacts; 2) multimodality: from semiotic resources used for illustrative and documentation purposes to semiotic resources conceived as means for enacting a scientific argument); 3) scientific journals: from a content-oriented journal focusing on the dissemination of the research findings to a multipurpose platform documenting and enacting the different steps of a research process.

In relation to this vision, future research could contribute to give a more concrete picture of what can be labelled a multimodal turn in scientific publishing. From a theoretical viewpoint, more research is needed regarding a) the mentoring process (requiring in-depth analyses of the actual interactions that take place during the design process), b) multimedia artefacts published in multimodal journals (how are multiple semiotic resources orchestrated), c) other multimodal approaches in other scientific publishing environments, d) the technical requirements and software platforms for designing multimedia

artefacts. From a practical viewpoint, and as a continuation of previous initiatives investigated in this work, a prototype of a multimodal journal based on the dimensions set out in this work could be developed dedicated to experimenting, testing multimodal scientific publishing.

References

Articles and Books

Ackerman and Redmond (2011). Multimedia digital scholarship. In ICSTI Workshop (2011, February 8), *Multimedia and visualization innovations for science*. http://research.microsoft.com/apps/video/default.aspx?id=145181

Adami, E. (2011a). In defence of multimodal re-signification. A response to Håvard Skaar's "In defence of writing." *Literacy*, 45(1), 44–50.

Adami, E (2011b). Mashing Genres Up, Breaking Them down: semiotic practices and literacy in the age of copy-and-paste." In Anais Do VI Simpòsio Internacional de Estudos de Gêneros Textuais. http://www.cchla.ufrn.br/visiget/pgs/pt/paineis/downloads/ElisabettaAdami.pdf

Aigner, W., Miksch, S., Schumann, H., & Tominski, C. (2011). Historical background. In *Visualization of time-oriented sata*, 15–44. London: Springer.

Anderson, S. F. (2009). Regeneration: multimedia genres and emerging scholarship. *Pre/Text: A Journal of Rhetorical Theory*, 20, n.pag. http://technocinema.usc.edu/wp-content/uploads/AndersonPreTextRegenerationOffprint.pdf

Anderson, S., & McPherson, T. (2011). Engaging digital scholarship: thoughts on evaluating multimedia scholarship. *Profession*, 2011(1), 136–151.

Anderson-Wilk, M., & Hino, J. (2011). Achieving rigor and relevance in online multimedia scholarly publishing. *First Monday*, *16*(12), n.pag. http://firstmonday.org/ojs/index.php/fm/article/view/3762

Andrews, R., Borg, E., David, S., Domingo, M. & England, J. (Eds.), *The SAGE handbook of digital dissertations and theses*. London: SAGE Publications Ltd.

Angrosh, M. A. (2005). Electronic and print journals: a value chain analysis. *ALIS*, *52*(2), 56–64.

Arlinghaus, S. L., & Zander, R. H. (1993). Electronic journals: observations based on actual trials, 1987-present. http://deepblue.lib.umich.edu/handle/2027.42/60200

Arlinghaus, S. L., & Zander, R. H. (2008). Electronic journals: then and now... a fifteen year retrospective. http://deepblue.lib.umich.edu/handle/2027.42/61418

Azuma, R. T. (1997). A survey of augmented reality. *Presence*, 6(4), 355–385.

Bachrach, S. M. (2001). Scientific journals of the future. In S. Berry & A. S. Moffat (Eds.), *The transition from paper: where are we going and how will we bet there?*. American Academy of Arts and Science. http://www.amacad.org/publications/trans4.aspx

Baldry, A (2000). Multimodality and multimediality in the distance learning age: papers in english linguistics. Campobasso, Italy: Palladino.

Ball, C. E. (2012). Assessing scholarly multimedia: a rhetorical genre studies approach. *Technical Communication Quarterly*, 21(1), 61–77.

Ball, C. E. (2013). Multimodal revision techniques in webtexts. *Classroom Discourse*, 5(1), 91–105.

Ball, C. E. (2014). Designed research. Publishing designs as scholarship. http://ceball.com/2014/06/15/designed-research-publishing-designs-as-scholarship/

Ballon, H., & Westermann, M. (2006). Art history and its publications in the electronic age. Houston, Tex.; Washington, D.C.: Rice University Press.

Banks, D. (2008c). Les premières images de la revue scientifique. *Les Philosophical Transactions*, 1665-1670. *La revue du GERAS*, 55: 5-22.

Banks, D. (2009). Notes on illustrations in some early issues of the *Philosophical Transactions*. In S. Slembrouck, M. Taverniers, & M. Van Herreweghe (Eds.), *From will to well. Studies in linguistics offered to Anne-Marie Simon-Vandenbergen*, 21–41. Ghent: Academic Press. http://biblio.ugent.be/record/910076

Barish, S., & Daley, E. (2004). Multimedia scholarship for the twenty-first century. In M. Devlin (Ed.), *The Internet and the University: Forum 2004*, 129–148.

Bateman, J., & Delin, J. (2001). From genre to text critiquing in multimodal documents. http://www.fb10.uni-bremen.de/anglistik/langpro/projects/gem/downloads/download.html

Bazerman, C. (1988). Shaping written knowledge: the genre and activity of the experimental article in science. Madison, Wisconsin, United States: Univ of Wisconsin Press.

Bazerman, C. (2011). Orders of knowledge and the future of genres. In *Anais do VI simpòsio internacional de estudos de gêneros textuais*. Natal (BR). http://www.cchla.ufrn.br/visiget/pgs/pt/paineis/downloads/CharlesBazerman.pdf

Beall, J. (2012, September 5). Two print journals completely hijacked by online hoodlums. http://scholarlyoa.com/2012/09/05/two-print-journals-completely-hijacked-by-online-hoodlums/

Beall, J. (2014, January 21). Have I discovered the source of the hijacked journals? http://scholarlyoa.com/2014/01/21/have-i-discovered-the-source-of-the-hijacked-journals/

Beaulieu, A. (2004). Mediating ethnography: objectivity and the making of ethnographies of the internet. *Social Epistemology*, 18(2-3), 139–163.

Beaulieu, A. (2010). From co-location to co-presence: shifts in the use of ethnography for the study of knowledge. *Social Studies of Science, 40(3)*, 453-470.

Beaulieu, A., Fry, J., Hellsten, I., Ratto, M., Scharnhorst, A., Vann, K., & Wouters, P. (2001). Messy shapes of knowledge. STS explores informatization, new media and academic work. In O. Hackett & O. Amsterdamska (Eds.), *Handbook of science and technology studies*, 3rd edition, 319–352. Cambridge and London: Mit Press.

Bezemer, J., & Kress, G. (2008). Writing in multimodal texts. *Written Communication*, *25*(2), 166-195.

Björk, B.-C. (2004). Open access - the new internet enabled business model for scientific publishing. *ECIS 2004 Proceedings*. http://aisel.aisnet.org/ecis2004/4

Björk, B.-C. (2007). A model of scientific communication as a global distributed information system. *IR Information Research*, 12(2), paper 307.

Björk, B.-C., Roos, A., & Lauri, M. (2009). Scientific journal publishing: yearly volume and open access availability. *Information Research*, 14(1). http://informationr.net/ir/14-1/paper391.html

Blanca, P. (2011). Les revues scientifiques: vers une intégration de la multimodalité. In *Anais do VI o Simpósio Internacional de Estudos dos Gêneros Textuais, Natal.* http://www.cchla.ufrn.br/visiget/pgs/pt/anais/Artigos/

Boellstorff, T. (2013). Making big data, in theory. *First Monday*, *18*(10). http://firstmonday.org/ojs/index.php/fm/article/view/4869

Bonde, A. (2008). Synthesis or aporia? Analyzing multimodal interaction from a musicological perspective. In *Proceedings of the 15th Nordic Congress of Musicology: Voicing. Sounding. Visualizing*. Oslo. http://foreninger.uio.no/nmf/NMFL_aug08/Bonde.pdf

Booth, P. J. (2012). Mashup as temporal amalgam: Time, taste, and textuality. *Transformative Works and Cultures*, 9(2012).

Borgman, C. L. (2007). Scholarship in the digital age: information, infrastructure, and the internet. Cambridge: MA: The MIT Press.

Bowie, J. (2001). Student problems with hypertext and webtext: a student-centered hypertext classroom. *Kairos*, *6*(2). http://english.ttu.edu/kairos/6.2/binder2.html?coverweb/hypertext/jonesbowieaustin/index.htm

Breure, L., Voorbij, H., & Hoogerwerf, M. (2011). Rich internet publications. Show what you tell. *Journal of Digital Information*, *12*(1). https://journals.tdl.org/jodi/index.php/jodi/article/view/1606

Brillenburg Wurth, K. (2006). Multimediality, intermediality, and medially complex digital Poetry. *Revue des littératures de l'Union Européenne*, 5, 1–18.

Broad, W. J. (1982). Journals: fearing the electronic future. *Science*, *216*(4549), 964 –968.

Brusilovsky, P. (2001). Adaptive hypermedia. *User Modeling and User-Adapted Interaction*, 11(1), 87–110.

Bucher, H. J., & Niemann, P. (2012). Visualizing science: the reception of powerpoint presentations. *Visual Communication*, 11(3), 283–306.

Burn, A. (2013). The kineikonic mode: towards a multimodal approach to moving image media. http://eprints.ncrm.ac.uk/3085/

Byrnes, J. E., Baskerville, E., Caron, B., Neylon, C., Tenopir, C., Schildhauer, M., … Lortie, C. J. (2013). *The four pillars of scholarly publishing: the future and a foundation*. PeerJ PrePrints. https://peerj.com/preprints/11v1.pdf

Caballero, R. (2008). Theorizing about genre and cybergenre. *CORELL: Computer Resources for Language Learning*, 2, 14–27.

Callahan, A., Cruz-Toledo, J., Ansell, P., & Dumontier, M. (2013). Bio2rdf release 2: improved coverage, interoperability and provenance of life science linked data. In P. Cimiano, O. Corcho, V. Presutti, L. Hollink, & S. Rudolph (Eds.), *The Semantic web: semantics and big data*, 200–212. Springer Berlin Heidelberg.

Casati, F., Giunchiglia, F., & Marchese, M. (2007). Liquid publications: scientific publications meet the web. http://eprints.biblio.unitn.it/archive/00001313/

Cawley, V. (2011). Is peer review unethical? An ethical analysis. In *International proceedings of economics development and research*, 106–112. http://www.ipedr.com/vol5.htm

Chang, C. (2000). Civilization and barbarism. Deconstructing logocentrism in the works of several communication scholars. *Intercultural Communication Studies*, 10(2), 121–144.

Chang, C. (2008, April 11). Repository, archive, network, database, library, platform: different names, same shtick? http://thewobblingmind.wordpress.com/2008/04/11/repository-archive-network-database-library-platform-different-names-same-shtick/

Chartier, R. (2013, March 24). La légende noire du monde électronique. http://www.lemonde.fr/iframe/jelec.html

Childers, P. B., & Lowry, M. J. (2005). Connecting visuals to written text and written text to visuals in science. *Across the Disciplines*. http://wac.colostate.edu/atd/visual/childers_lowry.cfm

Cicconi, S. (1993). Toward a definition of multimediality. Vakki, Finland. http://www.cisenet.com/index.php?p=739.

Coffey, A., Renold, E., Dicks, B., Soyinka, B., & Mason, B. (2006). Hypermedia ethnography in educational settings: possibilities and challenges. *Ethnography and Education*, 1(1), 15–30.

Córdoba, S., & Coto-Solano, R. (2008). Characteristics shared by the scientific electronic journals of latin america and the caribbean. In *ELPUB 2008 International Conference on Electronic Publishing*, Toronto (Canada), June, 2008, n.pag. http://eprints.rclis.org/handle/10760/11898

Cronin, B. (1984). The citation process. The role and significance of citations in scientific communication. London: Taylor Graham

Curwood, J. S. (2012). Cultural shifts, multimodal representations, and assessment practices: a case study. *E-Learning and Digital Media*, 9(2), 232–244.

Da Silva, A. V. L. (2008). DELL'ISOLA, Regina Lúcia Péret. Retextualização de gêneros escritos. *Signum*, *11*(2), 327–330.

Davis, D. (2011). 2011: Writing with sounds (Introduction), *Currents in Electronic Literacy,* 2011. http://currents.cwrl.utexas.edu/2011

Demorgon, J. (2004). Complexité des cultures et de l'interculturel: contre les pensées uniques. Paris: Economica.

Dena, C. (2009). Transmedia practice: theorising the practice of expressing a fictional world across distinct media and environments. http://www.scribd.com/doc/52231937/DENA-TransmediaPractice

De Siqueira Freitas, N. (2010). Nas teias da intermidialidade. O carandiru de varella e o de babenco. *Revista Anpoll*, 2(27). http://www.anpoll.org.br/revista/index.php/rev/article/view/143

Devereux, G. (1967). From anxiety to method in the behavioral sciences. Mouton.

Diakopoulos, N. (2005). Remix culture. Mixing up authorship. http://www.nickdiakopoulos.com/Documents/Remix%20culture%20mixing%20up%20authorship.doc

Dicks, B., Soyinka, B., & Coffey, A. (2006). Multimodal ethnography. *Qualitative Research*, *6*(1), 77–96.

Djonov, E. (2007). Website hierarchy and the interaction between content organization, webpage and navigation design: a systemic functional hypermedia discourse analysis. *Information Design Journal*, 15(2), 143–161.

Dos Santos Cunha, J. M. (2010). Tão felizes, nunca fomos. Literatura e cinema em tempos de autoritarismo. *Revista Anpoll*, 2(27). http://www.anpoll.org.br/revista/index.php/rev/article/view/143

Dressen, D. (2002). Identifying textual silence in scientific research articles: recontextualizations of the field account in geology. *Hermes, Journal of Linguistics*, *28*, 81–108.

Dreyfus, S., Stenglin, M., & Hood, S. (Eds.). (2012). *Semiotic margins: meaning in multimodalities*. Continuum.

Duncum, P. (2004). Visual culture isn't just visual: multiliteracy, multimodality and meaning. *Studies in Art Education: A Journal of Issues and Research in Art Education*, 45(3), 252–264.

Eason, K., Carter, C., Harker, S., Pomfrett, S., Phillips, K., & Richardson, J. (1997). *A comparative analysis of the role of multi-media electronic journals in scholarly disciplines*. http://www.ukoln.ac.uk/services/elib/papers/supporting/#tavistock

Edwards, M. G. (2000). The integral cycle of knowledge: some thoughts on integrating Ken Wilber's developmental and epistemological models. *Integral World*. http://www.integralworld.net/edwards2.html

Edwards, M. G. (2009). An integrative metatheory for organisational learning and sustainability in turbulent times. *The Learning Organization*, 16(3), 189–207.

Elleström, L. (Ed.). (2010). *Media borders, multimodality and intermediality*. Houndmills: Palgrave Macmillan.

Engeström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit Oy. http://lchc.ucsd.edu/mca/Paper/Engestrom/expanding/toc.htm

Engeström, Y., & Sannino, A. (2010). Studies of expansive learning: foundations, findings and future challenges. *Educational Research Review*, 5(1), 1–24.

Esposito, J. (2011, April 26). Publishing through the wormhole: a new format for the born-digital publisher. http://scholarlykitchen.sspnet.org/2011/04/26/publishing-through-the-wormhole-a-new-format-for-the-born-digital-publisher/

Fenner, M. (2013). What can article-level metrics do for you? *PLoS Biology*, *11*(10), e1001687.

Ferdig, R. E., & Pytash, K. E. (Eds.). (2013). *Exploring multimodal composition and digital writing*. Hershey PA: IGI Global.

Ferris, T.K., and Sarter N.B. 2008.Cross-modal links among vision, audition, and touch in complex environments. *Human factors* 50(1): 17–26.

Fischman, J. (2012, November 2). Researchers in the lab, ready for their close-up. *The Chronicle of Higher Education*. http://chronicle.texterity.com/chronicle/20121102a?pg=28#pg28

Fitzpatrick, K. (2011a). Planned obsolescence: publishing, technology, and the future of the academy. New York: NYU Press, 2011.

Fitzpatrick, K. (2011b). The digital future of authorship: rethinking originality. *Culture Machine*, *12*. http://www.culturemachine.net/index.php/cm/article/viewArticle/433

Fitzpatrick (shimla2901), K. (2008, March 10). Hypermediation, immediacy, and other categories of media. http://machines.pomona.edu/51-2008/node/203/

Fitzpatrick, K. (2007). MediaCommons: scholarly publishing in the age of Internet. http://mediacommons.futureofthebook.org/mcpress/scholarlypublishing/.

FitzSimons, G. E. (2003). Using Engeström's expansive learning framework to analyse a case study in adult mathematics education. *Literacy & Numeracy Studies: An International Journal of Education and Training of Adults*, 12(2), 47–63.

Flewitt, R. (2011). Bringing ethnography to a multimodal investigation of early literacy in a digital age. *Qualitative Research*, 11(3), 293 –310.

Folker, S., Sichelschmidt, L., & Ritter, H. (2005). Processing and integrating multimodal material - the influence of color-coding. In *Proceedings of the 27th annual conference of the Cognitive Science Society (CogSci'2005), B. G. Bara and L. Barsalou and M. Bucciarelli (Eds.)*, 690–695. Mahwah, NJ: Erlbaum.

Foot, K. A. (2014). Cultural-historical activity theory: exploring a theory to inform practice and research. *Journal of Human Behavior in the Social Environment*, 24(3), 329–347.

Foot, K., & Groleau, C. (2011). Contradictions, transitions, and materiality in organizing processes. An activity theory perspective. First Monday 16(6). http://firstmonday.org/ojs/index.php/fm/article/view/3479.

Forceville, C. (2007). Multimodal metaphor in ten Dutch TV commercials. *The Public Journal of Semiotics*, 1(1), 15–34.

Forceville, C. J., & Urios-Aparisi, E. (Eds.). (2009). *Multimodal metaphor*. De Gruyter Mouton.

Gambier, Y., & Gottlieb, H. (Eds.). (2001). *(Multi)media translation: concepts, practices, and research*. John Benjamins Publishing.

Garfield, E. (1980). Has scientific communication changed in 300 years? *Current Contents*, (8), 5–11.

Gross, A. G., Harmon, J. E., & Reidy, M. S. (2002). *Communicating science: the scientific article from the 17th century to the present*. New York: Oxford University Press, USA.

Guaraná, B. (2010, December 15). Multimedia integration and the future of scholarship. http://www.nyu.edu/tisch/preservation/program/student_work/2010fall/10f_1807_guarana

Guay, T. (1995). Web publishing paradigms. http://www.uni.edu/chen/mcluhan/Paradigm.html

Hammond, J., & Shipley, R. (1994). Considerations for the use of multimedia with scientific and technical information: a case study. In *IPCC '94 Proceedings. Scaling New Heights in Technical Communication*, 304–310. http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=347505&isnumber=8046

Hanacek, J. (2011). Phases of research process. http://www.academia.edu/6430105/4Phases_of_research_process_-_Hanacek

Harnad, S., & Carr, L. (2000). Integrating, navigating and analyzing eprint archives through open citation linking (the OPCIT project). *Cogprints*, 629–638.

Hawreliak, J. (2013, July 31). Hybrid publishing. The case for the middle-state. http://www.firstpersonscholar.com/the-case-for-the-middle-state/

Heller, S. R. (1996). Publishing on the internet: a proposal for the future. *Anal. Chem.*, (15), 111–114.

Hendler, J. (2007a). Reinventing academic publishing, part 1. *IEEE Intelligent Systems*, 22(5). http://dx.doi.org/10.1109/MIS.2007.93

Hendler, J. (2007b). Reinventing academic publishing, part 2. *IEEE Intelligent Systems*, 22(6). http://dx.doi.org/10.1109/MIS.2007.116

Hendler, J. (2008). Reinventing academic publishing, part 3. *IEEE Intelligent Systems*, 23(1). http://dx.doi.org/10.1109/MIS.2008.12

Hengl, T., & Gould, M. (2002). Rules of thumb for writing research articles. http://www.itc.nl/library/Papers/hengl_rules.pdf

Herschman, A. (1970). The primary journal: past, present, and future. *Journal of Chemical Documentation*, *10*(1), 37–42.

Hilligoss, S., & Howard, T. (2002). *Visual communication: a writer's guide*. New York: Longman.

Hine, C. M. (2000). *Virtual ethnography*. London ; Thousand Oaks, Calif: SAGE Publications Ltd.

Hocks, M. E. (2003). Understanding visual rhetoric in digital writing environments. *College Composition and Communication*, 54(4), 629–656.

Holoviak, J., & Seitter, K. (1997). Earth Interactions: Transcending the Limitations of the Printed Page. *Journal of Electronic Publishing* 3(1). http://dx.doi.org/10.3998/3336451.0003.102.

Höök, K. (2012). Affective computing: affective computing, affective interaction and technology as experience. In D. Soegaard, M. Soegaard, & R. Friis (Eds.), *Encyclopedia of Human-Computer Interaction*. http://www.interaction-design.org/encyclopedia/affective_computing.html

Houser, R. A. (2014). Science and the research process. In *Counseling and Educational Research: Evaluation and Application*, 3–15. Thousand Oaks, CA: SAGE Publications, Inc.

Hurdley, R., & Dicks, B. (2011). In-between practice: working in the "thirdspace" of sensory and multimodal methodology. *Qualitative Research*, 11(3), 277–292.

Iedema, R. (2003). Multimodality, resemiotization. Extending the analysis of discourse as multi-semiotic practice. *Visual Communication*, 2(1), 29 –57.

Ince, D. C., Hatton, L., & Graham-Cumming, J. (2012). The case for open computer programs. *Nature*, *482*, 485–488.

Jakubowicz, A. (2007). Bridging the Mire between e-research and e-publishing for multimedia digital scholarship in the humanities and social sciences. An Australian case study. *Webology*, 4(1), Article 38. http://www.webology.org/2007/v4n1/a38.html

Jakubowicz, A. (2009). Beyond the static text. Multimedia interactivity in academic journal publishing in the humanities and social sciences (not). *UTSePress Research*. http://epress.lib.uts.edu.au/research/handle/10453/12500

Jankowski, N. W. (2011). Enhancing scholarly publishing in the humanities and social sciences: innovation through hybrid forms of publication. http://ssrn.com/abstract=1929687

Jankowski, N. W., & Jones, S. (2013). Scholarly publishing and the internet: a NM&S themed section. *New Media & Society*, 15(3), 345–358.

Jewitt, C. (Ed.). (2009). *The routledge handbook of multimodal analysis*. London: Routledge.

Jewitt, C., & Kress, G. (2003). *Multimodal literacy*. Bern: Peter Lang.

Jones, J. (2008). Multiliteracies for academic purposes: a metafunctional exploration of intersemiosis and multimodality in university textbook and computer-based learning resources in science. http://ses.library.usyd.edu.au/handle/2123/2259

Journet, D., Ball, C., & Trauman, R. (Eds.). (2012). *The new work of composing*. Logan, UT: Computers and Composition Digital Press / Utah State University Press. http://ccdigitalpress.org/nwc/

Kalmbach, J. (2006). Reading the archives: ten Years on nonlinear (Kairos) history. Kairos, 11(1). http://kairos.technorhetoric.net/11.1/binder.html?topoi/kalmbach/index.html

Kallinikos, J., Aaltonen, A., & Márton, A. (2013). The ambivalent ontology of digital artifacts. *MIS Quarterly*, 37(2), 357–370.

Kain, D. & Wardle, E. (Eds.) (2014). Activity theory: an introduction for the writing classroom. In *Writing about writing*, 273–83. New York: Bedford.

Kenney, A. R., Entlich, R., Hirtle, P. B., McGovern, N. Y., & Buckley, E. L. (2006). *E-journal archiving metes and bounds: a survey of the landscape*. Washington, DC: Council on Library and Information Resources.

Kling, R. (2004). The internet and unrefereed scholarly publishing. *Annual Review of Information Science and Technology*, *38*(1), 591–631.

Kling, R., & Callahan, E. (2003). Electronic journals, the internet, and scholarly communication. *Annual Review of Information Science and Technology*, *37*(1), 127–177.

Knapton, Olivia. Publishing in multimodal formats: opportunities and challenges." TESOL Quarterly 47, no. 4 (2013): 856–66.

Knox, J. (2007). Visual-verbal communication on online newspaper home pages. *Visual Communication*, 6(1), 19–53.

Knox, R. (2013, October 3). Some online journals will publish fake science, for a fee. http://www.npr.org/blogs/health/2013/10/03/228859954/some-online-journals-will-publish-fake-science-for-a-fee

Koch, P., & Oesterreicher, W. (2001). Gesprochene sprache und geschriebene sprache / langage parlé et langage écrit. In G. Holtus, M. Metzeltin, & C. Schmitt (Eds.), *Methodologie (Sprache in der Gesellschaft / Sprache und Klassifikation / Datensammlung und -verarbeitung)*, 584–627. Berlin, New York: De Gruyter.

Kress, G. (2005). Gains and losses: New forms of texts, knowledge, and learning. *Computers and Composition*, 22(1), 5–22.

Kress, G. (2009). Multimodality: a social semiotic approach to contemporary communication. London: Routledge.

Kress, G. (2011). Discourse analysis and education: a multimodal social semiotic approach. In R. Rogers (Ed.), *An Introduction to Critical Discourse Analysis in Education*, 205–226. London: Routledge.

Kress, G. (2012). Researching in conditions of provisionality: reflecting on the phd in the digital and multimodal era. In R. Andrews, E. Borg, S. David, M. Domingo, & J. England (Eds.), *The SAGE handbook of digital dissertations and theses,* 245-258. London: SAGE Publications Ltd.

Kress, G., & Selander, S. (2012). Multimodal design, learning and cultures of recognition. *The Internet and Higher Education*, 15(4), 265–268.

Kriegeskorte, N. (2012). Open evaluation: a vision for entirely transparent post-publication peer review and rating for science. *Frontiers in Computational Neuroscience*, 6(79), 1-18.

Krippendorff, K. (2012). Conceptual fondation. In *Content analysis: An introduction to its methodology*, 24-48). London:Sage.

Kronick, D. A. (1976). History of scientific and technical periodicals: the origins and development of the scientific and technical press, 1665-1790. Lanham, Maryland, United States: Rowman & Littlefield.

LaFollette, M. C. (2000). Observations on fraud and scientific integrity in a digital environment. *Journal of the American Society for Information Science*, 51(14), 1334–1337.

Lancaster, F. W. (1989). Electronic publishing. *Library Trends*, *37*(3), 316–25.

Lancaster, F. W. (1995). The evolution of electronic publishing. *Library Trends*, *43*(4), 518–27.

Landner, R. (2004). *Toward the automated tactilization of graphical images*. http://search.engrant.com/project/NpTQYe/sger_toward_the_automated_tactilization_of_graphical_images

Laplantine, F. (2005). Le social et le sensible. Introduction à une anthropologie modale. Paris: Téraèdre.

Latour, B. (1988). *Science in action: how to follow scientists and engineers through society*. Cambridge, Massachusetts, United States: Harvard University Press.

Latour, B., & Woolgar, S. (1986). *Laboratory life: the construction of scientific facts*. Princeton, N.J.: Princeton University Press.

Lauer, C. (2009). Contending with terms:"multimodal" and "multimedia" in the academic and public spheres. *Computers and Composition*, 26(4), 225–239.

Lee, K. (2012). Augmented reality in education and training. *TechTrends*, 56(2), 13–21.

Lemke, J. (1998). Multiplying meaning: visual and verbal semiotics in scientific text. In J. Martin & R. Veel (Eds.), *Reading science: Critical and functional perspectives on discourses of science*, 87–113. London: Routledge.

Lemke, J. L. (2002). Travels in hypermodality. *Visual Communication*, *1*(3), 299 –325.

Leppänen, S., Kytölä, S., Jousmäki, H., Westinen, E., & Peuronen, S. (2013). Entextualization and resemiotization as resources for identification in social media. In *The language of social media*. Palgrave Macmillan. http://www.palgraveconnect.com/pc/doifinder/10.1057/9781137029317.0010

Lewis, P. H., Wilkins, R. J., Griffiths, S. R., Davis, H. C., & Hall, W. (1995). Content based navigation in an open hypermedia environment. *Image and Vision Computing*, 16(12-13), 921–929.

Liew, A. (2007). Understanding data, information, knowledge and their inter-relationships. *Journal of Knowledge Management Practice*, 8(2). http://www.tlainc.com/articl134.htm

Linkov, F., Lovalekar, M., & LaPorte, R. (2006). Scientific Journals are "faith based": is there science behind Peer review? *Journal of the Royal Society of Medicine*, 99(12), 596–598.

Liu, Y., & O'Halloran, K. L. (2009). Intersemiotic Texture: analyzing cohesive devices between language and images. *Social Semiotics*, 19(4), 367–388.

Lynch, C. A. (2003). Institutional repositories: essential infrastructure for scholarship in the digital age. *Portal: Libraries and the Academy*, 3(2), 327–336.

Mackenzie Owen, J. (2010). The scientific article in the age of digitization. New York: Springer.

Manovich, L. (2002). Models of authorship in new media. http://manovich.net/articles/

Manovich, L. (2007a). Understanding hybrid media. http://manovich.net/articles/

Markauskaite, L. (2010). Digital media, technologies and scholarship: some shapes of eResearch in educational inquiry. *Australian Educational Researcher (Australian Association for Research in Education)*, 37(4), 79–101.

Marshall, E. (2002). Clear-cut publication rules prove elusive. *Science (New York, N.Y.)*, *295*(5560), 1625.

Martínez-Arellano, F. F. (2013). What is library and information science (LIS) in latin american library schools. *Revue de l'ENSSIB*, 2013/1. http://revue.enssib.fr

Márton, A. (2010). The transfigurability of digital objects. *Artnodes* (10), 62-68. http://www.uoc.edu/ojs/index.php/artnodes/article/view/n10-marton

Masten, D. L., & Plowman, T. M. P. (2003). Digital ethnography: the next wave in understanding the consumer experience. *Design Management Journal (Former Series)*, 14(2), 75–81.

Mavers, D. (2007). Semiotic resourcefulness: a young child's email exchange as design. *Journal of Early Childhood Literacy*, 7(2), 155 –176.

Mayernik, M. (2007). The prevalence of additional electronic features in pure e-journals. *The Journal of Electronic Publishing*, *10*(3). http://dx.doi.org/10.3998/3336451.0010.307

Mazzolini, R. G. (Ed.). (1993). *Non-verbal communication in science prior to 1900*. Firenze, Italy: Olschki.

McCormick, M. (2010, April 27). Digital scholarly publishing: innovative publishing services for NYU. *Connect: Information Technology*. http://www.nyu.edu/about/news-publications/publications/connect-information-technology/2010/04/27/digital-scholarly-publishing.html

McKenzie, J. (1999). The research cycle. *Now On - The Educational Technology Journal*, 9(4). http://www.fno.org/dec99/rcycle.html

McKiernan, G. (2002). E is for Everything: the extra-ordinary, evolutionary [E-]Journal. In The Serials Librarian 41(3–4), 293–321.

McKiernan, G. (2003a). Scholar-Based Innovations in Publishing. Part I: individual and institutional initiatives. *Library Hi Tech News*, 20(2). http://www.emeraldinsight.com/journals.htm?articleid=1489913&show=html

McKiernan, G. (2003b). Scholar-based innovations in publishing. Part II: library and professional initiatives. *Library Hi Tech News*, 20(3). http://www.emeraldinsight.com/journals.htm?articleid=1489925&show=html

McKiernan, G. (2003c). Scholar-based innovations in publishing. Part III: organizational and national initiatives. *Library Hi Tech News*, 20(5). http://www.emeraldinsight.com/journals.htm?articleid=1489950&show=html

McMahon, B. (2010, June 7). Visualisation of chemical data. Use cases for publication of Crystal Structures. PowerPoint presented at the DataCite Summer Meeting, Hannover, DE. http://www.docstoc.com/docs/93495432/Crystallography-Journals-Online.

McPherson, T. (Ed.). (2009). In focus: digital scholarship and pedagogy. *Cinema Journal*, 48(2), 119–160.

McPherson, T. (2010a). Scaling Vectors. Thoughts on the future of scholarly communication. *Journal of Electronic Publishing*, 13(2). http://dx.doi.org/10.3998/3336451.0013.208

McPherson, T. (2012, November 15). An overview of multimodal publishing. http://engl252.wordpress.com/2012/11/14/workshop-presentation-scalar/

Meredith, D. (2010). *Explaining research: how to reach key audiences to advance your work*. Oxford ; New York: Oxford University Press, USA.

Mochocka, A. (2009). Między Interaktywnością a Intermedialnością Książka Jako Przestrzeń Gry. Homo Ludens 1: 155–76.

Molz, M. & Edwards, M.G. (2010 forthcoming). Crossing Boundaries, Stimulating Creativity: The Horizon of Integral Meta-Studies. In A.K. Giri (Ed.), *Pathways to Creative Research: Towards A Festival of Dialogues.* New Dehli: Shipra.

Morris, S. (2007). Mapping the journal publishing landscape: how much do we know? *Learned Publishing*, 20(4), 299–310.

Mulligan, A., Hall, L., & Raphael, E. (2013). Peer review in a changing world: an international study measuring the attitudes of researchers. *Journal of the American Society for Information Science and Technology*, *64*(1), 132–161.

Murthy, D. (2008). Digital ethnography: an examination of the use of new technologies for social research. *Sociology*, 42(5), 837–855.

New London Group. (1996). A pedagogy of multiliteracies: designing social futures. *Harvard Educational Review*, 66(1, 60-92.

Newton, H. Breaking boundaries in academic publishing: launching a new format for scholarly research. *Insights: The UKSG Journal* 26 (1): 70–76.

Nicolescu, B. (2008). Transdisciplinarity–history, methodology, hermeneutics. In *Management of Information, Knowledge and Wisdom. Experiential Management*, 13–23. http://www.ugb.ro/etc/issues/issueno2-2008#page=13

Norris, S. (2004b). Multimodal discourse analysis. A conceptual framework. In R. Scollon & P. LeVine (Eds.), *Discourse and technology: Multimodal discourse analysis*, 101–15. Washington, D.C.: Georgetown University Press.

Odlyzko, A. M. (1995). Tragic loss or good riddance? The impending demise of traditional scholarly journals (full version). *International Journal of Human-Computer Studies*, *42*, 71–122.

O'Halloran, K. L. (1999). Interdependence, interaction and metaphor in multisemiotic texts. *Social*, 9(3), 317–354.

O'Halloran, K. L., Tan, S., Smith, B. A., & Podlasov, A. (2009). Digital semiotics. http://multimodal-analysis-lab.org/_docs/pubs07-10th_IASS_Proceedings_Digital%20Semiotics.pdf

O'Halloran, K., & Smith, B. A. (2010). Multimodal studies: an emerging research field. In K. L. O'Halloran & B. A. Smith (Eds.), *Multimodal Studies: Exploring Issues and Domains*, 1-41. New York & London: Routledge.

O'Neil, J. (2006). The remix aesthetic. Originality mixed and mashed-up. http://www.mcluhanremix.com/images/Oneil_Remix_1D_SHORT.pdf

O'Neil, J. (2008). Remix identity. Cultural mash-ups and aesthetic violence in digital media. http://www.mcluhanremix.com/images/oneil_remix_identity5Kc.pdf

O'Neill, D. K. (2001). Knowing when you've brought them in: scientific genre knowledge and communities of practice. *Journal of the Learning Sciences*, *10*(3), 223-264.

Open Science Collaboration. (2012). An open, large-scale, collaborative effort to estimate the reproducibility of psychological science. *Perspectives on Psychological Science*, *7*(6), 657–660.

Oppenheim, C. (2008). Electronic scholarly publishing and open access. *Journal of Information Science*, 34(4), 577–590.

O'Toole, M. (1995). *The language of displayed art*. Leicester: Leicester Univ Press.

Palter, Steven F. (2012, June 19). New multimedia article format revoutionizes medical research. *Docinthemachine*. http://docinthemachine.com/medical-publishing-revolution/.

Pahl, K., & Rowsell, J. (Eds.). (2006). Travel notes from the new literacy studies: instances of practice. Clevedon United Kingdom: Multilingual Matters.

Palmeri, J. (2012). *Remixing composition: a history of multimodal writing pedagogy*. Carbondale: Southern Illinois University Press.

Palter, S. F. (2012, June 19). New multimedia article format revoutionizes medical research. http://docinthemachine.com/medical-publishing-revolution/

Pettifer, S., McDermott, P., Marsh, J., Thorne, D., Villeger, A., & Attwood, T. K. (2011). Ceci n'est pas un hamburger: modelling and representing the scholarly article. *Learned Publishing*, 24(3), 207–220.

Pink, D. S. (2007). *Doing visual ethnography*. London: Sage Publications Ltd.

Presner, T. (2012). How to evaluate digital scholarship. *Journal of Digital Humanities*, 1(4). http://journalofdigitalhumanities.org/1-4/how-to-evaluate-digital-scholarship-by-todd-presner/

Renaux, S. (2010). A outra volta do parafuso: relações transmediais de texto e imagem em Henry James e Charles Demuth. *Revista Anpoll*, 2(27). http://www.anpoll.org.br/revista/index.php/rev/article/view/143

Renear, A. H., & Palmer, C. L. (2009). Strategic reading, ontologies, and the future of scientific publishing. *Science*, *325*(5942), 828–832.

Ritchey, T. (1998). General morphological analysis: a general method for non-quantified modelling, 2002– 2006. http://190.11.224.74:8080/jspui/handle/123456789/632

Ritchey, T. (2011). Wicked problems. Social messes: decision support modelling with morphological analysis. New York: Springer.

Roosendaal, H. E., & Geurts, P. A. T. M. (1997). Forces and functions in scientific communication: an analysis of their interplay. http://doc.utwente.nl/60395/

Sacramento State Library. The scientific publishing cycle (2006). http://library.csus.edu/guides/metzgerd/biotutorial/biolit/litcycle.html#

Saint-Georges, I. de, & Weber, J.-J. (Eds.). (2013). *Multilingualism, multimodality and the future of education research*. SensePublishers. http://link.springer.com.proxy.bnl.lu/chapter/10.1007/978-94-6209-266-2_1

Salter, A. J., & Gann, D. M. (2001). The role of middle range publications in the development of engineering knowledge. *SPRU Working Paper Series* 58. http://ideas.repec.org/p/sru/ssewps/58.html

Schaffner, A. C. (1994). The future of scientific journals: lessons from the past. *Information Technology & Libraries*, 13(4), 239–248.

Scolari, C. A. (2009). Transmedia storytelling: implicit consumers, narrative worlds, and branding in contemporary media production. *International Journal of Communication*, 3, 586–606.

Selfe, C. L., & Takayoshi, P. (2007). Thinking about multimodality. In C. L. Selfe (Ed.), *Multimodal composition: resources for teachers*, 1–12. Cresskill, NJ: Hampton Press.

Shaffer, D. W., & Clinton, K. A. (2006). Toolforthoughts: reexamining thinking in the digital age. *Mind, Culture & Activity*, 13(4), 283–300.

Sharp, D. (2001). Formal structure of scientific journals and types of scientific papers. Treballs de la Societat Catalana de Biologia, 51, 109–17.

Sheehan, R. J., & Rode, S. (1999). On scientific narrative: stories of light by Newton and Einstein. *Journal of Business and Technical Communication*, 13(3), 336–358.

Shotton, D. (2009). Semantic publishing: the coming revolution in scientific journal publishing. *Learned Publishing*, 22(2), 85–94.

Shotton, D. (2012). The five stars of online journal articles. A framework for article evaluation. *D-Lib Magazine*, 18(1/2). http://www.dlib.org/dlib/january12/shotton/01shotton.html

Simeão, E. L. M. S., & Miranda, A. L. C. de. (2005). The format of the online scientific journal in the extensive communication model, In *8th International Conference on Electronic Publishing*, Brasília (Brasil), June 2004. http://eprints.rclis.org/5555/

Smith, J. (1999). Prolegomena to any future e-publishing model. In *Redefining the information chain, new ways and voices*, 293–98. ICCC Publishing, 1999. http://kar.kent.ac.uk/18959/.

Smithies, J. (2012). Evaluating scholarly digital outputs: the six layers approach. *Journal of Digital Humanities*, 1(4). http://journalofdigitalhumanities.org/1-4/evaluating-scholarly-digital-outputs-by-james-smithies/

Sollaci, L. B., & Pereira, M. G. (2004). The introduction, methods, results, and discussion (IMRaD) structure: a fifty-year survey. *Journal of the Medical Library Association*, 92(3), 364–371.

Specker, E. (2005). Metalanguage - a review. *The Linguist List*. http://linguistlist.org/pubs/reviews/get-review.cfm?SubID=56147

Spiro, L. (2007, November 22). Doing digital scholarship. http://digitalscholarship.wordpress.com/2007/11/22/doing-digital-scholarship/

Stang, A., Poole, C., & Schmidt-Pokrzywniak, A. (2008). Pre-peer review, peer review, and post-peer review: three areas with potential for improvement. *Journal of Clinical Epidemiology*, *61*(4), 309–310.

Steele, C. (2006). Digital publishing and the konwledge process. In H. S. Ching, P. W. T. Poon, & C. McNaught (Eds.), *eLearning and Digital Publishing,* 175–193. Springer Netherlands.

Stegh Camati, A. (2010). Sonho de uma noite de verão no cinema. Travessias e transações Intermidiáticas. *Revista Anpoll* 2(27). http://www.anpoll.org.br/revista/index.php/rev/article/view/143.

Stemler, S. (2001). An Overview of Content Analysis. *Practical Assessment, Research & Evaluation* 7(17). http://pareonline.net/getvn.asp?v=7&n=17

Stichweh, R. (2003). The multiple publics of science: inclusion and popularization. In *Soziale Systeme*, 9(2), 210–220. Lucius & Lucius.

Superti-Furga, G., Wieland, F., & Cesareni, G. (2008). Finally: the digital, democratic age of scientific abstracts. *FEBS Letters*, *582*(8), 1169.

Swan, A. (2006). Overview of scholarly communication. In J. Neil (Ed.), *Open Access: Key Strategic, Technical and Economic Aspects*, 4–11. Chandos.

Szklo, M. (2006). Quality of scientific articles. *Revista de Saúde Pública*, *40*(SPE), 30–35.

Taipale, S. (2014). The affordances of reading/writing on paper and digitally in Finland. *Telematics and Informatics*, *31*(4), 532–542.

Takahashi, M., Yates, J., & Herman, G. (2010). *A comprehensive framework for considering practices and processes*. Social Science Research Network. http://papers.ssrn.com/abstract=1777375

Tanselle, T. (2000). The concept of format. *Studies in Bibliography*, 53, 67–115.

Tietje, L., & Cresap, S. (2005). Hegemonic visualism. *Radical Pedagogy*, 7(1). http://www.radicalpedagogy.org/radicalpedagogy/Hegemonic_Visualism.htmlbucher

Toomlinson, M. M. (2014). Transmodal redesign in music and literacy: diverse multimodal classrooms. https://www.academia.edu/7389898/Tomlinson_M.M._2014_._Transmodal_redesign_in_music_and_literacy_Diverse_multimodal_classrooms._Journal_of_Early_Childhood_Literacy

Toppano, E., & Roberto, V. (2009). Semiotic design and analysis of hypermedia. *Proceedings of the 20th ACM Conference on Hypertext and Hypermedia HT 09*, 367.

Treloar, A. (1998). *Hypermedia online publishing:the transformation of the scholarly journal*. School of Information Management and Systems, Monash University, Melbourne, Australia. http://andrew.treloar.net/research/theses/phd/index.shtml

Tufte, E. (2003, September 11). PowerPoint is evil - Power corrupts. PowerPoint corrupts absolutely. *Wired*. http://www.wired.com/wired/archive/11.09/ppt2.html

Tufte, E. R. (2006a). *Beautiful evidence*. Cheshire: Graphics Press.

Tufte, E. R. (2006b). *The cognitive style of PowerPoint: pitching out corrupts within*. Cheshire. Connecticut, USA: Graphics Press.

Unsworth, L. (2006). Towards a Metalanguage for Multiliteracies Education: Describing the Meaning-Making Resources of Language-Image Interaction. *English Teaching: Practice and Critique* 5(1):55–76.

Unsworth, L. (2007). Image/text relations and intersemiosis: towards multimodal text description for multiliteracies education. In *Proceedings of the 33rd International Systemic Functional Congress,* 1165–1205. http://www.pucsp.br/isfc/proceedings/Artigos%20pdf/59pl_unsworth_1165a1205.pdf

Van de Sompel, H., Payette, S., Erickson, J., Lagoze, C., & Warner, S. (2004). Rethinking scholarly communication: building the system that scholars deserve. *D-Lib Magazine*, *10*(9). http://www.dlib.org/dlib/september04/vandesompel/09vandesompel.html

van Leeuwen, T. (1999). *Speech, music, sound*. Houndmills: Palgrave Macmillan.

van Leeuwen, T. (2005). Introducing social semiotics: an introductory textbook . London: Routledge.

Vannini, P. (2014). Nonrepresentational theory and methodologies: re-envisioning research. http://www.academia.edu/5217885/Nonrepresentational_Theory_and_Methodologies_Re-envisioning_Research

Varga, Á. K. (2004). Mediality and forms of interpretation of artworks. *Neohelicon*, 30(2).

Ventola, E., & Guijjaro, A. J. M. (Eds.). (2009). *The world told and the world shown: multisemiotic issues*. Basingstoke, UK: Palgrave Macmillan.

Vickery, B. (1997). Metatheory and information science. *Journal of Documentation*, *53*(5), 457–476.

Vickery, B. C. (2000). *Scientific communication in history*. Lanham, Maryland, United States: The Scarecrow Press, Inc.

Villanueva, M.L., Luzón, J. M., & Ruiz-Madrid, N. (2008). Understanding digital genres as semiotic artefacts: meaning and cognition beyond standardized genres. *Computers and Composition Online*. http://www2.bgsu.edu/departments/english/cconline/DigitalGenres/

Volpe. (2002). Algorithms for aural representation and presentation of quantitative data to complement and enhance data visualization (abstract). http://www.cs.rpi.edu/research/phdabstracts/volpe.html

von Goldammer, E., Paul, J., & Newbury, J. (2003). Heterarchy-hierarchy: two complementary categories of description. http://www.vordenker.de/heterarchy/a_heterarchy-e.pdf

Vorländer, M. (2011). Auralization: fundamentals of acoustics, modelling, simulation, algorithms and acoustic virtual reality (2008 edition.). Berlin; London: Springer.

Wahlster, W., André, E., Graf, W., & Rist, T. (1991). Designing illustrated texts. How language production is influenced by graphics generation. http://citeseer.ist.psu.edu/viewdoc/summary?doi=10.1.1.18.1237

Walker, T. J. (1997). The electronic future of scientific journals. *American Entomologist*. http://entnemdept.ufl.edu/walker/aedraft.htm

Whitworth, B., & Friedman, R. (2009a). Reinventing academic publishing online. Part 1: Rigor, relevance and practice. *First Monday*, 14(8). http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/viewArticle/2609/2248#author

Whitworth, B., & Friedman, R. (2009b). Reinventing academic publishing online. Part 2: A socio-technical vision. *First Monday*, 14(9). http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/viewArticle/2642/2287

Willinsky, J. (2000). Proposing a knowledge exchange model for scholarly publishing. *Current Issues in Education*, *3*(6). http://cie.ed.asu.edu/volume3/number6/

Willinsky, J. (2003). The future of scholarly publishing. *Current Science*, *84*(7), 873-874

Willis, J., & Bull, G. (2000). Setting the priorities: electronic scholarly publishing for instructional technology and teacher education. *CITE Journals*, *1*(1). http://www.citejournal.org/vol1/iss1/editorials/article2.htm

Zatz, M. (2000). What's a scientific journal for? *Journal of Biological Rhythms*, *15*(6), 451–452.

Zhang, Y., & O'Halloran, K. L. (2012). The gate of the gateway: a hypermodal approach to university homepages. *Semiotica*, 2012(190).

Journal Websites and Webpages

NOTE: Websites and webpages: availability last checked, 30.08.2014. *Screenshots are also listed below by URL and by date when applicable*.

AAPSJ. The American Association of Pharmaceutical Scientists Journal. http://www.aapsj.org/default.asp

~ About. http://www.aapsj.org/about/default.asp

~ Submission. http://www.aaps.org/AAPSPTinstructionsauthors.

ACM. (n.d.). Transactions on Multimedia Computing, Communications and Applications. TOMCCAP authors guide. http://tomccap.acm.org/guide.htmlACP. Atmospheric Chemistry and Physics. http://www.atmospheric-chemistry-and-physics.net/home.html

~ Submission. www.atmospheric-chemistry-and-physics.net/submission/general_terms.html

AIME. The AIME Project. http://www.modesofexistence.org

~ Crossings. http://www.modesofexistence.org/crossings/#/en/cont

~ Blog. (2013, 23 August) http://www.modesofexistence.org/welcoming-blog-reading-groups/

~ Blog. (2013, 20 December). http://www.modesofexistence.org/workshop-call-for-contributions-on-the-economy-in-aime-at-the-copenhagen-business-school-24-26-february-2013/

AIP. AIP Advances. http://aipadvances.aip.org/

ARLO. Acoustics Research Letters Online. http://asadl.org/arlo/

BE Essay. Stories from dance. A multimodal essay example. In *Bearsenglish* http://bearsenglishpage2010-2011.wikispaces.com/Multimodal+Essay+Example

BG. Biogeosciences. http://www.biogeosciences.net/

~ Article. http://www.biogeosciences.net/11/issue17.html

BJ. Biochemical Journal. http://www.biochemj.org/bj/default.htm

~ Classic. http://www.biochemj.org/bj/cp/2013/bj2013c001.htm

~ Structures. http://www.biochemj.org/bj/3dstructures.htm

~ Wikipedia. http://en.wikipedia.org/wiki/Biochemical_Journal

BMJ. The British Medical Journal. http://www.bmj.com/

CCO. Computers and Compostion Online. http://casit.bgsu.edu/cconline/

~ Submission. http://casit.bgsu.edu/cconline/sub.htm

~ Editorial. http://www2.bgsu.edu/departments/english/cconline/ed_welcome/winter2013.html

CEC. CrystEngComm. http://pubs.rsc.org/en/journals/journalissues/ce#!recentarticles&all

~ About. http://www.rsc.org/publishing/journals/ce/about.asp

~ Wikipedia. http://en.wikipedia.org/wiki/CrystEngComm

CEL. Currents in Electronic Literacy. http://currents.cwrl.utexas.edu/

~ Submission. http://currents.cwrl.utexas.edu/spring02/submissions.html

CITE. Contemporary Issues in Technology and Teacher Education. http://www.citejournal.org

CJO. Crystallography Journals Online. http://journals.iucr.org/

~ Sample. http://journals.iucr.org/services/subscriberservices.html

~ CrossRef. http://www.crossref.org/crossmark/

DHN. Digital Humanities Now. http://digitalhumanitiesnow.org/

~ About. http://digitalhumanitiesnow.org/about/

EIJ. Earth Interactions Journal. http://earthinteractions.org/

~ Question. http://earthinteractions.org/EI_FAQ.html

EJGE. Electronic Journal of Geotechnical Engineering. http://www.ejge.com/Index_ejge.htm

~ Magazine. http://www.ejge.com/iGEM/Oldies-1.htm

ELSEVIER. http://www.elsevier.com

~ Article (2009). Article of the future. http://www.elsevier.com/about/mission/innovative-tools/article-of-the-future

~ Abstract. Graphical abstracts. http://www.elsevier.com/journal-authors/graphical-abstract

ECR. Enculturation. http://www.enculturation.net/

~ About. http://www.enculturation.net/about

EOL. Ethnomusicology Online. http://www.umbc.edu/eol/index.html.

EPAA. Education Policy Analysis Archives. http://epaa.asu.edu/ojs/

~ Policies. http://epaa.asu.edu/ojs/about/editorialPolicies

F1000 (Faculty of 1000). http://f1000.com/

~ About. http://f1000.com/prime/about/faqs

~ Research. http://f1000research.com/.

FRONTIERS. http://www.frontiersin.org/

~ About. http://www.frontiersin.org/AboutFrontiers.aspx

~ Community. http://www.frontiersin.org/about/frontierscommunity

~ Forum. www.frontiersin.org/news/Frontiers_releases_new_Interactive_Review_Forum/530

~ Gloassary. http://www.frontiersin.org/about/glossary

~ Homepage. http://www.frontiersin.org/

~ Users. http://www.frontiersin.org/RegisteredUserConditions.aspx

~ Wikipedia. https://en.wikipedia.org/wiki/Frontiers_Media

FNS. Fertility & Sterility. http://www.fertstert.org/

~ About. http://fertstertforum.com/about/

CP. CommentPress. http://futureofthebook.org/commentpress/

IA. Internet Archaeology. http://intarch.ac.uk/index.html

~ About. http://intarch.ac.uk/about/saa-ia.html

IHO. Instute of Human Origins (2008). *Becoming Human*. http://www.becominghuman.org/.

IJLM. International Journal of Learning and Media. http://ijlm.net/

IMEJ. Interactive Multimedia Electronic Journal of Computer-Enhanced Learning. http://imej.wfu.edu/

~ About. http://imej.wfu.edu/about/infoforauthor.asp

~ Article. http://imej.wfu.edu/Articles/1999/1/01/index.asp

IMR. In Media Res. http://mediacommons.futureofthebook.org/imr/

~ About. http://mediacommons.futureofthebook.org/imr/about-media-res-0

~ Article. http://mediacommons.futureofthebook.org/imr/2014/06/25/repetition-nostalgia-and-obsessive-joy-lego-video-games

~ Call. http://mediacommons.futureofthebook.org/imr/current-calls

~ Clip. (2015). Soapy Broads and Quality Gentlemen: The Antiheroine in Top of the Lake. http://www.criticalcommons.org/Members/barussell/clips/use-of-video-in-twin-peaks-and-top-of-the-lake/embed_view

INTACT. Molecular Interaction Database. http://www.ebi.ac.uk/intact/

IPOL. Image Processing On Line. http://www.ipol.im/

~ Submission. http://www.ipol.im/meta/submission/

JAMS. Journal of the American Musicological Society. http://www.ams-net.org/pubs/jams.php

~ Review (2014, 10 May). http://musicologynow.ams-net.org/2014/05/haps-at-jams.html

JAR. Journal for Artistic Research. http://www.jar-online.net/index.php/

~ Exhibition. http://www.researchcatalogue.net/view/35560/56271

~ Issue. http://www.jar-online.net/index.php/issues/view/484

JASA-EL. Journal of the Acoustical Society of America Express Letters. http://asadl.org/jasael/

~ Submission. http://scitation.aip.org/journals/doc/ASALIB-home/corp/pdf/jasael/jasaelstyle.pdf

JCMC. Journal of Computer-Mediated Communication. http://jcmc.indiana.edu/

~ Submission. http://unmcomm.wiki-site.com/index.php/Journal_of_Computer_Mediated_Communication

JCS. Journal of Cell Science. http://jcs.biologists.org/

~ Articles. http://jcs.biologists.org/site/author/article_types.xhtml

~ Poster. http://jcs.biologists.org/content/126/19/4325/suppl/DC1

JMCS. Journal of Multimodal Communication Studies. http://jmcs.home.amu.edu.pl/?page_id=11

JMMH. Journal for MultiMedia History. http://www.albany.edu/jmmh/

~ About. http://www.albany.edu/jmmh/vol3/introduction3.html

~ Article. http://www.albany.edu/jmmh/vol1no1/elijahmuhammad.html

JMUI. Journal on Multimodal User Interfaces. http://rd.springer.com/journal/12193

JoVE. Journal of Visualized Experiments. http://www.jove.com/

~ About. http://www.jove.com/about

~ Archive. http://www.jove.com/archive

~ Information. http://www.jove.com/publish

~ PubMed. (2014, 15 August). http://www.ncbi.nlm.nih.gov/pubmed/25145703

~ Submission. http://www.jove.com/files/Instructions_for_Authors.pdf

~ Subscribe. http://www.jove.com/subscribe

JSAH. Journal of the Society of Architectural Historians. http://www.sah.org/publications-and-research/jsah

JSCM. Journal of Seventeenth-Century Music. http://www.sscm-jscm.org/Welcome.html

~ Submission, http://sscm-jscm.org/contributing-to-jscm/

JTC. Journal of Technology in Counseling. http://jtc.columbusstate.edu/.

KAIROS. http://www.technorhetoric.net/about.html

~ About. http://kairos.technorhetoric.net/about.html

~ Archive. http://kairos.technorhetoric.net/archive.html

~ Issue. http://technorhetoric.org/11.1/topoi/eyman/cites.html

~ Style. http://kairos.technorhetoric.net/styleguide.html#xhtml

~ Submission. http://kairos.technorhetoric.net/submissions.html

~ Webtext: http://kairos.technorhetoric.net/15.2/topoi/ericsson-et-al/index.html

LRR. Living Reviews in Relativity. http://relativity.livingreviews.org/

~ About. http://relativity.livingreviews.org/About/concept.html

~ Question. http://www.livingreviews.org/faq.html

M&A. Music and Anthropology. http://www.levi.provincia.venezia.it/ma/index.htm

~ Submission. http://www.umbc.edu/MA/ma_guid.htm

~ Article. http://www.umbc.edu/MA/index/number4/virolle/vir0.htm

MC. Multimodal Communication. http://multimodalcommunication.com/

MTO. Music Theory Online. http://www.mtosmt.org/

~ Article. http://www.mtosmt.org/issues/mto.14.20.3/mto.14.20.3.lundberg.html

~ Submission. http://www.mtosmt.org/docs/authors.html

NEJM. The New England Journal of Medicine. http://www.nejm.org/

~ Perspective. http://www.nejm.org/medical-articles/perspective

~ Audio Interview. http://www.nejm.org/doi/full/10.1056/NEJMp1412488

~ Audio Summary. http://www.nejm.org/action/showIssueAudio?a=nejm_2014.371.issue-10.summary.mp3&area=&viewType=Popup&viewClass=Audio

NJ. NewJour. http://www.library.georgetown.edu/newjour/front

~ About. http://www.library.georgetown.edu/newjour/content/history-facts

NJP. New Journal of Physics. http://iopscience.iop.org/1367-2630

~ Abstract. http://iopscience.iop.org/1367-2630/videoabstracts

~ Video. http://iopscience.iop.org/1367-2630/16/12/122001

PE. Palaeontologia Electronica. http://palaeo-electronica.org/content/

~ Call. http://palaeo-electronica.org/english.htm

PHILICA. http://www.philica.com/

~ Submission. http://www.philica.com/submit.php

RB. ResearchBlogging. http://researchblogging.org/

~ About. http://researchblogging.org/static/index/page/about

REIP. Revista de Enfermedades Infecciosas en Pediatría. http://www.enfermedadesinfecciosas.com/revista.php

RW. Retraction Watch. http://retractionwatch.wordpress.com/

~ About. http://retractionwatch.com/2010/08/03/why-write-a-blog-about-retractions/

SCIGEN. (n.d.) Stribling, J., Krohn, M., & Aguayo, D. http://pdos.csail.mit.edu/scigen/

SCIVEE. http://www.scivee.tv/

~ Brochure. http://www.scivee.tv/brochure

SLRG. (n.d.). Steven Ley Research Group. http://www.leygroup.ch.cam.ac.uk/?page_id=5114

SSP. Southern Spaces. http://southernspaces.org/

~ About. http://southernspaces.org/about

~ Submission. http://southernspaces.org/submission-guidelines

TCR. Teachers College Record. http://www.tcrecord.org/

~ TCR Section. https://vialogues.com/vialogues/play/20345

SCALAR. The Alliance for Networking Visual Culture. http://scalar.usc.edu/scalar/

JUMP. Journal of Undergraduate Multimedia Projects. http://jump.cwrl.utexas.edu/

TDS. Trem do Samba. (2012). Cohen, O., Apolinario, D., Di Giacomo, F., Vespa, D., Hueck, K., Sodré, R., Vilaverde, C., Becattini, N., Rittmeister, L., Moreira, J. and Miranda, F. http://super.abril.com.br/multimidia/trem-samba-722528.shtml

TM. ThoughtMesh. http://thoughtmesh.net/

~ About. http://thoughtmesh.net/faq.html

VIALOGUE. https://vialogues.com/support/about

VECTORS. Journal of Culture and Technology in a Dynamic Vernacular. http://www.vectorsjournal.org/issues/index.php?issue=6

~ About. http://vectors.usc.edu/journal/index.php?page=Introduction

~ Archive. http://vectors.usc.edu/issues/2/placestorming/msg_placestorming.html

~ Editorial. http://vectors.usc.edu/issues/index.php?issue=7

~ Project. http://salt.unc.edu/T-RACES/

VJSDM. Video Journal of Semantic Data Management. http://videolectures.net/semantic_data_management_video_journal_vol1/

WP Design. Communication design. (n.d.). In *Wikipedia* http://en.wikipedia.org/w/index.php?title=Communication_design&oldid=578776553

Appendices

Appendix 1: Exploratory Phase: Scientific Publishing Environments

NAME	About (from the viewpoint of initiators)	Web-site	ISSN	Publishing environment	Research areas	1st (on-line) issue	Last issue
Academia Stack Exchange	Academia is a question and answer site for academics of all levels. It's built and run by you as part of the Stack Exchange network of Q&A sites. With your help, we're working together to build a library of detailed answers to every question about academia.	http://academia.stackexchange.com/		FORUM (Question & Answer)		2014	2014
Academic Evolution	Academic Evolution is a blog dedicated to discussing where the new media is leading higher education, publishing, and teaching as the traditional institutions for producing and communicating knowledge are both enhanced and challenged in the digital age.	http://www.academicevolution.com/		BLOG	Digital publishing, New media	2008	2010
Academic Leadership Journal in student research (ALJ)	Open access journal (publications available online for users to read, download, copy, distribute, and use with attribution) ... Professional learning community with innovative user tools to allow readers and editors to add ratings, comments, editor notes, and discussions to published articles	http://www.academicleadership.org/	1533-7812	JOURNAL	Multi-disciplinary	2003	2013
Acoustics Research Letters Online (ARLO)	Acoustics Research Letters Online (ARLO), an electronic letters journal of The Acoustical Society of America (ASA) includes articles devoted to research in all fields of Acoustics, which were published from 1999 through 2005. It is now entirely archival ... all articles published to date continue to be available for online viewing.	http://asadl.org/arlo/	1529-7853	JOURNAL	Acoustics	1999	2005
Across the Disciplines (ATD)	Across the Disciplines, a refereed journal devoted to language, learning, and academic writing, publishes articles relevant to writing and writing pedagogy in all their intellectual, political, social, and technological complexity.	http://wac.colostate.edu/atd/	1554-8244	JOURNAL	Language, Learning, Academic Writing	2004	2013

AIP Advances	As an open access journal with advanced web 2.0 tools, the global research community will be able to find, share, evaluate, and discuss scientific research in new ways. AIP Advances puts relevant content and discussion tools in the hands of the community to shape the direction of the physical sciences.	http://aipadvances.aip.org/	2158 - 3226	JOURNAL	Physical Sciences	2011	2014
Anthro Source	The online repository of the journals of the American Anthropological Association. Launched in 2004, AnthroSource contains current issues for fifteen of the AAA's peer-reviewed publications, as well as an archive of the journals, newsletters, and bulletins published by the American Anthropological Association and its member sections.	http://www.aaanet.org/publications/anthrosource/		REPOSITORY	Anthro pology	2004	2014
arXiv	The arXiv (pronounced "archive", as if the "X" were the Greek letter Chi, χ) is an archive for electronic preprints of scientific papers in the fields of mathematics, physics, astronomy, computer science, quantitative biology, statistics, and quantitative finance which can be accessed online. In many fields of mathematics and physics, almost all scientific papers are self-archived on the arXiv.	http://arxiv.org/		REPOSITORY (Preprint)	Physics, Mathematics & Computer Science, Quantitative Biology…	1991	2014
Atmospheric Chemistry and Physics (ACP)	Atmospheric Chemistry and Physics is an open access publication of the European Geosciences Union. It is a peer-reviewed scientific journal publishing studies investigating the Earth's atmosphere and the underlying chemical and physical processes.	http://www.atmospheric-chemistry-and-physics.net/	1680 - 7316	JOURNAL	Geosciences	2001	2014
Australian Humanities Review (AHR)	Australian Humanities Review provides a forum for open intellectual debate across humanities disciplines, about all aspects of social, cultural and political life, primarily (but not exclusively) with reference to Australia.	http://www.australianhumanitiesreview.org/	1325 8338	JOURNAL	All disciplines in the humanities	1996	2013
Behavioral and Brain Sciences (BBS)	BBS is the internationally renowned journal with the innovative format known as Open Peer Commentary. Particularly significant and controversial pieces of work are published from researchers in any area of psychology, neuroscience, behavioural biology or cognitive science, together with 10-25 commentaries on each article from specialists within and across these disciplines, plus the author's response to them...	http://journals.cambridge.org/action/displayJournal?jid=BBS	1469 - 1825	JOURNAL	Psychology, neuro-science, behaviou-ral biology or cognitive science	1996	2014

Bio-Alive	Bio-alive is a life science online video sharing community, and the premier destination to watch and share biology and life science related videos worldwide through the web. Our mission is to promote scientific literacy and web based education by providing a online community for video sharing in all biology and life science related fields.	http://bio-alive.com/		REPOSITORY (Video sharing library)	Life Science, Biology	2010	2014
bio2rdf	The Bio2RDF project aims to transforms silos of life science data into a globally distributed network of linked data for biological knowledge discovery. Bio2RDF creates and provides machine understandable descriptions of biological entities using the RDF/RDFS/OWL Semantic Web languages.	http://bio2rdf.org/		AGGREGATOR (Searchable database, Linked data)	Life Sciences	2005	2014
Biochemical Journal (BJ)	The Biochemical Journal is one of the world's leading life science journals, publishing over 4000 pages of high-quality scientific information every year. It is dedicated to the development of biochemical knowledge and features papers from all fields of biochemistry, cellular and molecular biology.	http://www.biochemj.org/bj/default.htm	1470 - 8728	JOURNAL	All fields of bio-chemistry and cellular & molecular biology	1999	2014
Biogeosciences (BG)	Biogeosciences (BG) is an international scientific journal dedicated to the publication and discussion of research articles, short communications and review papers on all aspects of the interactions between the biological, chemical and physical processes in terrestrial or extraterrestrial life with the geosphere, hydrosphere and atmosphere. ... Experimental, conceptual and modelling approaches are welcome.	http://www.biogeosciences.net	1726 - 4170	JOURNAL	Bio-geo-sciences	2004	2014
ChemSpider	ChemSpider is a free chemical structure database providing fast text and structure search access to over 26 million structures from hundreds of data sources.	http://www.chemspider.com/		SEARCHABLE DATABASE	Chemistry	2007	2014
CiteSeer X beta	CiteSeerx is an evolving scientific literature digital library and search engine that focuses primarily on the literature in computer and information science. CiteSeerx aims to improve the dissemination of scientific literature and to provide improvements in functionality, usability, availability, cost, comprehensiveness, efficiency, and timeliness in the access of scientific and scholarly knowledge.	http://citeseerx.ist.psu.edu/index		SEARCHABLE DATABASE (Digital library)	Computer and Information Science	1997	2014

CogPrints	An electronic archive for self-archive papers in any area of Psychology, Neuroscience, and Linguistics, and many areas of Computer Science... as well as any other portions of the physical, social and mathematical sciences that are pertinent to the study of cognition.	http://cogprints.org/		REPOSITORY (Self-archiving website)	Psychology, neuro science, linguistics, computer science, etc.	1997	2014
Committee on publication ethics (COPE)	COPE is a forum for editors and publishers of peer-reviewed journals to discuss all aspects of publication ethics. It also advises editors on how to handle cases of research and publication misconduct.	http://publicationethics.org/		FORUM	Publication ethics	2007	2014
Computers and Composition Online (CCO)	Computers and Composition Online is the refereed online companion journal to Computers and Composition: ... Our goal is to be a significant online resource for scholar-teachers interested in the impact of new and emerging media upon the teaching of language and literacy in both virtual and face-to-face forums.	http://www.bgsu.edu/departments/english/cconline/inde	1873 - 2011	JOURNAL	Teaching of language, Literacy	2003	2014
Contemporary Issues in Technology and Teacher Education (CITE)	The CITE Journal is an online, peer-reviewed journal, established and jointly sponsored by five professional associations (AMTE, ASTE, NCSS-CUFA, CEE, and SITE). This is the only joint venture of this kind in the field of teacher education. Each professional association has sole responsibility for editorial review of articles in its discipline.	http://www.citejournal.org	1528 - 5804	JOURNAL SERIES	Teacher education	2000	2014
Critical Commons	Critical Commons is a public media archive and fair use advocacy network that supports the transformative reuse of media in scholarly and creative contexts. ... for numerous electronic publishing efforts that directly engage media as objects of analysis, curation and critique. ... On online platform for viewing, tagging, sharing, annotating curating and spreading media.	http://www.criticalcommons.org/		REPOSITORY (Video sharing video, Archive)	Scholarly Publishing and communication	2008	2014
Crystallography Journals Online	International Scientific Union. Publishes 8 research journals (Acta A Acta B Acta C Acta D Acta E Acta F JAC JSR). Publishes major reference work International Tables for Crystallography (8 volumes). Promotes standard crystallographic data file format (CIF).	http://journals.iucr.org	2053 - 2733	JOURNAL	Crystallography	1999	2014
CrystEng Comm	Launched in October 1999, CrystEngComm has established itself as THE journal in which to publish cutting-edge crystal engineering research. The journal publishes Communications, Full Papers, Highlights and Letters. Its current impact factor is 3.84.	http://pubs.rsc.org/en/journals/journalissues/ce#!recentar	1466 - 8033	JOURNAL	Crystal engineering research	1999	2014

Currents in Electronic Literacy	Currents in Electronic Literacy advances digital literacies by critiquing and assessing the present state of the field. We construe electronic literacy widely to include literature, rhetoric and composition, languages (English, foreign, and ESL), communication studies, education, and pedagogy.	http://currents.cwrl.utexas.edu/	1524-6493	JOURNAL	Electronic Literacy	1999	2013
Cyber metrics	Cybermetrics is both an Electronic-only Journal and a Virtual Forum (The Journal) devoted to the study of the quantitative analysis of scholarly and scientific communications in the Internet. It is open to world-wide researchers to publish and discuss their findings. Internet offers them new and increased capabilities to distribute their results to a greater audience.	http://cybermetrics.cindoc.csic.es/cybermetrics.html	1137-5019	JOURNAL	Scholarly and scientific communication	1997	2012
Dermatology Online Journal	An open-access, refereed publication intended to meet reference and education needs of the international dermatology community since 1995. …	http://dermatology.cdlib.org/DOJvol1num2/diabetes/diab	1087-2108	JOURNAL	Dermatology	1995	2014
Dig yourself into…	This blog focuses on the Issues of Publication and Design.	http://ylmay.blogspot.com/		BLOG	Design, Publication	2009	2009
Digital Humanities Now (DHNow)	DHNow showcases the scholarship and news of interest to the digital humanities community through a process of aggregation, discovery, curation, and review. Digital Humanities Now also is an experiment in ways to identify, evaluate, and distribute scholarship on the open web through a weekly publication and the quarterly Journal of Digital Humanities.	http://digitalhumanitiesnow.org/		AGGREGATOR (Blog)	Digital Humanities	2006	2014
Digital Scholarship in the Humanities	I hope that the title “Digital Scholarship in the Humanities” doesn’t seem too pretentious–it seemed like the best summary of what I’m hoping to consider in this blog. I plan to explore how digital resources and tools are affecting scholarship in the humanities and consider the potential for digital scholarship.	http://digitalscholarship.wordpress.com/		BLOG	Digital Scholarship	2007	2013

DNA Tube	DnaTube is a scientific site providing video based studies, lecturers and seminars. On January 18, 2007, we started DnaTube.com to allow a self-growing community to share their scientific experiences and videos. One of the best features of the DnaTube.com, is that it supports other types of scientific works through flash animations, powerpoints, in addition to videos.	http://www.dnatube.com/		REPOSITORY (Video sharing library)	Multidisciplinary (43 channels)	2007	2014
Earth Interactions	Earth Interactions publishes papers that explore the interactions among the biological, physical, and human components of the Earth system.	http://earthinteractions.org/	1087-3562	JOURNAL	Geophysics	1997	2014
eBird	eBird is an online database of bird observations providing scientists, researchers and amateur naturalists with real-time data about bird distribution and abundance.... Documenting the birds in your world… Global tools for birders, critical data for science.	http://ebird.org/content/ebird		REPOSITORY (Thematic database)	Ornithology	2002	2014
Education Policy Analysis Archives (EPAA/ AAPE)	EPAA/AAPE is a peer-reviewed, open-access, international, multilingual, and multidisciplinary journal designed for researchers, practitioners, policy makers, and development analysts concerned with education policies …	http://epaa.asu.edu/ojs/	1068-2341	JOURNAL	Education Policies	1993	2014
Electronic Journal of Geotechnical Engineering (EJGE)	The primary objective of The Electronic Journal of Geotechnical Engineering is to create an open forum for rapid, interactive, peer-reviewed information exchange in Geotechnical Engineering, World-wide.	http://www.ejge.com/Index_ejge.htm	1089-3032	JOURNAL	Geotechnical Engineering	1996	2014
Electronic Transactions on Artificial Intelligence (ETAI)	The Electronic Transactions on Artificial Intelligence (ETAI) has pioneered a new view of how scientific results may be communicated. Traditional scientific journals are organized to fit the paper-and-print technology; ETAI is organized to make the best use of Internet technology, in particular by using a new and different peer-review system.	http://www.etaij.org/	1403-3526	JOURNAL	Artificial Intelligence	1997	2002
Enculturation	Enculturation is a refereed journal devoted to contemporary theories of rhetoric, writing, and culture. We accept academic work in all media forms suitable for web-based publication, including conventional articles, hypertexts, videos, and multimedia projects. Submitted articles and projects are blind-reviewed and considered for publication on the understanding that they are not under consideration elsewhere.	http://www.enculturation.net/	1525-3120	JOURNAL	Rhetoric, Writing, Culture	1997	2014

Ethno musicology Online (EOL)	Peer-reviewed multimedia Web journal... Ethnomusicology Online (EOL) seeks high-quality scholarly and general submissions in ethnomusicology and related disciplines, especially but not exclusively submissions which take advantage of the multimedia and hypertext capabilities of the World Wide Web.	http://www.umbc.edu/eol/index.html	1092-7336	JOURNAL	Ethno-musicology	1995	2005
Faculty of 1000 (F1000 Posters)	F1000Posters, an open access repository, provides a permanent, structured environment for the deposition of posters and slide presentations as well as a trustworthy venue for ongoing discussion and development of the information being presented.	http://f1000.com/posters		REPOSITORY (Archive)	Life Sciences	2010	2014
Faculty of 1000 (F1000 Prime)	F1000 Prime is a revolutionary post-publication peer review service that comprehensively and systematically highlights and recommends the most interesting articles published in the biomedical sciences, based on the recommendations of a faculty of 5,000 of the world's leading scientists and clinical researchers (called "Faculty Members")...	http://f1000.com/prime		SERVICE (PEER REVIEW SERVICE)	Life sciences	2000	2014
Fertility and Sterility (FNS)	Fertility & Sterility has been the leader in reproductive medicine research. Now here you can leveraging the power of the internet, social media, and multimedia to connect all of us to fill in the void.	http://fertstertforum.com/	0015-0282	JOURNAL	Medicine Research	2012	2014
Fire	Fire!!! The Multimedia Journal of Black Studies. The founding of Fire!!! will promote scholarship that gives direction to Black Studies, but sees its unique contribution as providing a publication venue for scholars who utilize multimedia evidence to advance their theories and interpretations.	http://fire-jbs.org/	2156-4078	JOURNAL	Cultural studies	2010	2013
First Monday	First Monday is one of the first openly accessible, peer–reviewed journals on the Internet, solely devoted to the Internet. Since its start in May 1996, First Monday has published 1,217 papers in 196 issues, written by 1,617 different authors. In addition, a number of special issues have appeared as well as podcasts at http://www.firstmondaypodcast.org/.	http://www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/index	1396-0458	JOURNAL	Internet	1996	2014
Flora Online	Flora Online was established by Richard H. Zander, January 12, 1987, to address a perceived need for publication of electronically searchable botanical text and MicroSoft Disk Operating System executable programs. It is first electronic journal to receive an ISSN number from the Library of Congress: ISSN 0892-9106.	http://www.mobot.org/plantscience/ResBot/14F0.htm	0892-9106	JOURNAL	Botanic	1987	1993

Frontiers	The Frontiers journals are an interdisciplinary series of open-access journals bringing a paradigm shift in academic publishing. All our journals are community-driven, thought of by researchers for researchers, and provide an interactive, constructive and highly-principled peer-review.	http://www.frontiersin.org/	XXXX-XXXX	JOURNAL SERIES	STM	2007	2014
Genamics JournalSeek	Genamics JournalSeek is the largest completely categorized database of freely available journal information available on the internet ... Genamics SoftwareSeek is a respository and database of freely-distributable and commercial tools for use in molecular biology and biochemistry.	http://genamics.com/		SEARCHABLE DATABASE			2014
Global Perspective on Digital History	Global Perspectives on Digital History is an actively multilingual journal dedicated to the digital publication of the historical field. ... Global Perspectives on Digital History aggregates and selects material from our Compendium of the Global Perspectives, drawing from hundreds of venues where high-quality scholarship ...	http://gpdh.org/		AGGREGATOR (Blog)	Digital History	2011	2014
Hybrid Pedagogy	Hybrid Pedagogy ... combines the strands of critical and digital pedagogy to arrive at the best social and civil uses for technology and digital media in on-ground and online classrooms ... An open peer reviewed journal that is both academic and collective.	http://www.hybridpedagogy.com/	2332-2098	JOURNAL	Pedagogy	2011	2014
Hypotheses	Hypotheses is a publication platform for academic blogs. It enables researchers to provide real-time updates of developments in their own research. Academic blogs can take numerous forms: accounts of archaeological excavations, current collective research or fieldwork; thematic research; books or periodicals reviews; newsletter etc. ... The Hypotheses team provides support and assistance to researchers for the technical and the editorial aspects of their project.	http://hypotheses.org/		BLOG (Publication Platform, Group blog)	Arts, Humanities & Social Sciences	2010	2014
Image Processing On Line (IPOL)	IPOL is a research journal of image processing and image analysis. Each article contains a text on an algorithm and its source code, with an online demonstration facility and an archive of experiments. Text and source code are peer-reviewed and the demonstration is controlled. IPOL is an Open Science and Reproducible Research journal.	http://www.ipol.im/	2105-1232	JOURNAL	Image Analysis	2011	2014

In Media Res	In Media Res is dedicated to experimenting with collaborative, multi-modal forms of online scholarship. Our goal is to promote an online dialogue amongst scholars and the public about contemporary approaches to studying media. In Media Res provides a forum for more immediate critical engagement with media at a pace closer to how we experience mediated texts.	http://mediacommons.futureofthebook.org/imr/		FORUM (Blog)	Online scholarship	2006	2014
IntAct	The MIntAct project--IntAct as a common curation platform for 11 molecular interaction databases ... IntAct provides a freely available, open source database system and analysis tools for molecular interaction data. All interactions are derived from literature curation or direct user submissions and are freely available.	http://www.ebi.ac.uk/intact/		REPOSITORY (Common curation platform)	Molecular interaction		2014
Inter Journal	Distributed self-organizing refereed journals on selected topics in science and engineering. ... The InterJournal (ISSN: 1081-0625) differs from conventional paper journals as well as from many electronic journals in a number of ways... 1) Redefining the word "manuscript" ... 2) Redefining the function of "refereeing" ... 3) Redefining the word "journal" from singular to plural	http://www.interjournal.org/	1081 - 0625	JOURNAL	Science and engineering	1996	2009
Inter médialités / Inter mediality	Since 2003, the journal ... has published, in French and English, articles grouped around verbs that act as pivotal themes and encompass a variety of objects, mediums, and conceptual lines. ... It addresses issues beyond the study of contemporary media and does not confine itself to a particular school. ... As a showcase for current “intermedial” artistic practices, the journal features a guest artist in each of its issues.	http://www.intermedialites.ca/	1920 - 3136	JOURNAL	Media Studies, Cinema, Arts…	2003	2013
International Journal of Learning and Media (IJLM)	The International Journal of Learning and Media (IJLM) provides a forum for scholars, researchers, and practitioners to examine the changing relationships between learning and media across a wide range of forms and settings. Our focus is particularly, but by no means exclusively, on young people, and we understand learning in broad terms to include informal and everyday contexts as well as institutions such as schools.	http://ijlm.net/	1943 - 6068	JOURNAL	Learning and Media Studies	2009	2012

Interactive Multimedia Electronic Journal of Computer-Enhanced Learning (IMEJ)	IMEJ is a prototype for an interactive multimedia electronic journal edited and produced at Wake Forest University. The goals of IMEJ are a) to provide a peer-reviewed forum for innovations in computer-enhanced learning, b) to serve as a model and testbed for an electronic journal with a high level of multimedia and interactivity, and c) to advance the acceptance of electronic publication as a legitimate and valuable form of academic discourse.	http://imej.wfu.edu/	1525 - 9102	JOURNAL	Computer-enhanced learning	1999	2005
Intermídias	A revista eletrônica Intermídias.com interage as várias mídias numa busca da opinião e do caráter reflexivo presente nos textos e nas obras. A intermidialidade é o movimento e o devir, lugar de um saber que não seria mais aquele do ser. Ou então, lugar de um pensamento do ser, não mais entendido como unidade e continuidade, mas como diferença e intervalo.	http://www.intermidias.com	1807 - 8001	JOURNAL	Mídia e cultura. Comunicação, cinema, artes e literatura	2004	
Internet Archaeology (IA)	Internet Archaeology is an independent, not-for-profit, peer-reviewed e-journal for archaeology. It publishes articles of a high academic standing which also try to utilise the potential of electronic publication. The journal has been publishing online since 1996. ... The journal is a hybrid Open Access journal so some content is freely available. Everything else is currently subject to a low-cost subscription (pay once, access forever).	http://intarch.ac.uk/	1363 - 5387	JOURNAL	Archaeology	1996	2014
Internet Journal of Chemistry (IJC)	The advent of the Internet, a global computer network, offers a new avenue for chemists to disseminate their research. Traditional print media is in fact quite limited in its ability to present much information of value to chemists…	None	1099 - 8292	JOURNAL	Chemistry	1998	2004
Journal for Artistic Research (JAR)	An inter-national, online, Open Access and peer-reviewed journal ... JAR abandons the traditional journal article format and offers its contributors a dynamic online canvas where text can be woven together with image, audio and video. These research documents called 'expositions' provide a unique reading experience while fulfilling the expectations of scholarly dissemination.	http://www.jar-online.net	2235 - 0225	JOURNAL	Artistic research	2011	2013
Journal of Artificial Intelligence Research (JAIR)	JAIR (ISSN 1076 - 9757) covers all areas of artificial intelligence (AI), publishing refereed research articles, survey articles, and technical notes. Established in 1993 as one of the first electronic scientific journals, JAIR is indexed by INSPEC, Science Citation Index, and MathSciNet.	http://www.jair.org/	1076 - 9757	JOURNAL	Artificial Intelligence	1993	2014

Journal of Cell Science (JCS)	Journal of Cell Science (JCS) is an international peer-reviewed journal in the field of cell biology that is published by The Company of Biologists, a not-for-profit charitable organization run by biologists for the benefit of the biological community.	http://jcs.biologists.org/	1477-9137	JOURNAL	Cell Biology	2000	2014
Journal of Cognitive and Brain Science (EJCBS)	The EJCBS ... as an experimental journal which is published in an electronic form on the World Wide Web (WWW). ... This type of publishing has never before been tested. Since the system is open for public review and examination it facilitates discussion among professionals. ... Acceptance of submitted material is judged by our on-line poll.	http://osiris.rutgers.edu/~zoli/ejcbs.html		JOURNAL	Science and mathematics	1997	2005
Journal of Computation and Mathematics (JCM)	It aims to publish high-quality research or expository papers in all areas where mathematics and computation meet (see the Scope listing below). Unlike many electronic journals, it has not been set up in order to meet the needs of one particular research community. ... The electronic format allows the relaxation of strict page limits, particularly for "add-ons". Nevertheless, the editors expect authors to be concise; the length of each paper should be appropriate to its content.	http://old.lms.ac.uk/jcm/	1461-1570	JOURNAL	Mathematics	1998	2007 (2014)
Journal of Computer-Mediated Communication (JCMC)	The Journal of Computer-Mediated Communication (JCMC) is a web-based, peer-reviewed scholarly journal. Its focus is social science research on computer-mediated communication via the Internet, the World Wide Web, and wireless technologies. Within that general purview, the journal is broadly interdisciplinary, publishing work by scholars in communication, business, education, political science, sociology, media studies, information science, and other disciplines.	http://jcmc.indiana.edu	1083-6101	JOURNAL	Social sciences	1995	2008 (2014)
Journal of Corrosion Science and Engineering (JCSE)	Topics covered are in the area of the scientific ramifications of chemical corrosion. All information is in full text form, including images, summaries, and conclusions of experiments performed, and it is free to any reader.	http://www.jcse.org	1466-8858	JOURNAL	Chemical corrosion	1995	2012
Journal of Digital Humanities (JDH)	The Journal of Digital Humanities (ISSN 2165-6673) is a comprehensive, peer-reviewed, open access journal ... The Journal of Digital Humanities offers expanded coverage of the digital humanities in three ways. First, by publishing scholarly work beyond the traditional research article. Second, by selecting content from open and public discussions in the field. Third, by encouraging continued discussion through peer-to-peer review.	http://journalofdigitalhumanities.org/	2165-6673	JOURNAL	Digital Humanities	2011	2013

Journal of Inequalities in Pure and Applied Mathematics (JIPAM)	JIPAM is a peer-reviewed international journal in the theory of mathematical inequalities and their applications.	http://www.emis.de/journals/JIPAM/index-	1443-5756	JOURNAL	Mathematics	1999	2009
Journal of Interactive Media in Education (JIME)	JIME is an open access online journal in educational technology that focuses on the implications and use of digital media in education. It aims to foster a multidisciplinary and intellectually rigorous debate on both the theory and practice of interactive media in education. JIME was launched in September, 1996.	http://jime.open.ac.uk	1365-893X	JOURNAL	Educational Technology	1996	2014
Journal of Multimodal Communication Studies (JMCS)	In JMCS we intend to focus on various aspects of multimodality in interpersonal and man-machine communication, with special attention to its interactional aspects and the human factor as investigated by disciplines such as linguistics, communication sciences, psychology and sociology, and supported by modern technical resources.	http://jmcs.home.amu.edu.pl/?page_id=11	2391-4033	JOURNAL	Multimodal Communication	2014	2014
Journal of Open Archaeology Data (JOAD)	The Journal of Open Archaeology Data (JOAD) features peer reviewed data papers describing archaeology datasets with high reuse potential. We work with a number of specialist and institutional data repositories to ensure that the associated data are professionally archived, preserved, and openly available. Equally importantly, the data and the papers are citable, and reuse is tracked.	http://openarchaeologydata.metajnl.com/		JOURNAL	Archaeology	2012	2013
Journal of Scholarly Publishing (JSP)	Journal of Scholarly Publishing targets the unique issues facing the scholarly publishing industry today. It is the indispensable resource for academics and publishers that addresses the new challenges resulting from changes in technology, funding and innovations in publishing.	http://muse.jhu.edu/journals/scp/	1710-1166	JOURNAL	Scholarly Publishing		2014
Journal of seventeenth-century Music (JSCM)	The Journal of Seventeenth-Century Music (JSCM) is published by the Society for Seventeenth-Century Music to provide a refereed forum for scholarly studies of the musical cultures of the seventeenth century. These include historical and archival studies, performance practice, music theory, aesthetics, dance, and theater. JSCM also publishes critical reviews and summary listings of recently published books, scores, and electronic media.	http://www.sscm-jscm.org/Welcome.html	1089-747X	JOURNAL	Music	1995	2010

Journal of Technology in Counseling (JTC)	The Journal of Technology in Counseling is a peer reviewed journal, published one to two times per year ... The Journal of Technology in Counseling publishes article on all aspects of practice, theory, research and professionalism related to the use of technology in counselor training and counseling practice.	http://jtc.columbus state.edu/	1527 - 6228	JOURNAL	Counselling	1999	2008
Journal of the Acoustical Society of America Express Letters (JASA-EL)	JASA Express Letters (JASA-EL) is devoted to providing rapid and open dissemination of important new research results and technical discussion in all fields of acoustics. It serves physical scientists, life scientists, engineers, psychologists, physiologists, architects, musicians, and speech communication specialists who wish to rapidly report the results of their acoustical research in letter-sized contributions.	http://asadl.org/jasa/	0001 - 4966	JOURNAL	Acoustics	1998	2014
Journal of the American Musico logical Society (JAMS)	One of the premier journals in the field, the Journal of the American Musicological Society (JAMS) publishes scholarship from all fields of musical inquiry: from historical musicology, critical theory, music analysis, iconography and organology, to performance practice, aesthetics and hermeneutics, ethnomusicology, gender and sexuality, popular music and cultural studies.	http://www.ams-net.org/pubs/jams.php	1547 - 3848	JOURNAL	Musical Studies		2014
Journal of the Society of Archi tectural Historians (JSAH)	The online version, dubbed JSAH Online, will support presentation methods -- such as video, virtual modeling and digital mapping -- that academics have employed for some time, but could show off only in venues with the capacity to handle to multimedia exhibitions, such as live demonstrations and museum installations.	http://www.sah.org/publications-and-research/jsah	2150 - 5926	JOURNAL	Archi tectural history	2010	2014
Journal of Visualized Experiments (JoVE)	Journal of Visualized Experiments (JoVE) is a peer reviewed, PubMed indexed journal devoted to the publication of biological, medical, chemical and physical research in a video format.	http://www.jove.com/	1940 - 087X	JOURNAL	Biology, Medical studies, Chemistry, Physics	2006	2014
Journal on Multimodal User Interfaces (JMUI)	The Journal on Multimodal User Interfaces fills the demonstrable need for a specifically multidisciplinary publication devoted to the domain of multimodal interfaces. As implied by the word Interfaces rather than Interactions in the title, the journal seeks to illustrate verifiable realisations over purely theoretical musings. The journal focuses on multimodal interfaces developed with an emphasis on user-centric design.	http://rd.springer.com/journal/12193	1783 - 8738	JOURNAL	Multimodal Interfaces	2007	2013

Journalology	Science Publishing Trends, Ethics, Peer Review, and Open Access	http://journalology.blogspot.com/		BLOG	Scholarly Publishing	2007	2012
Kairos	Kairos is a refereed open-access online journal exploring the intersections of rhetoric, technology, and pedagogy. ... Kairos publishes bi-annually, in August and January, with regular special issues in May. Our current acceptance rate for published articles is approximately 10%.	http://kairos.technorhetoric.net/	1521 - 2300	JOURNAL	Rhetoric, Technology & Pedagogy	1996	2014
La Criée	La vente des journaux à la criée était un dur métier. La Criée est une tentative paresseuse de distribution gratuite de revues et périodiques gratuits mais non sans valeur. Elle est destinée à rendre utilisables rapidement les signets que je réunis pour alimenter la Liste AZ des Périodiques électroniques le catalogue des périodiques électroniques du SCD de l'Université Toulouse 2.	http://periodiques.wordpress.com/		BLOG (Database)	Journalology	2008	2014
Labyrinthe	Une revue fondée en 1998. Elle a pour ambition d'être un lieu de recherche et d'expérimentation dans le domaine des savoirs littéraires, philosophiques, historiques et sociaux. Elle est ouverte à tous les chercheurs, exigeants et curieux, quels que soient leur âge, leur statut et leurs orientations théoriques. Labyrinthe s'efforce en particulier d'accueillir autant de premières publications qu'il est possible.	http://labyrinthe.revues.org/	1950 - 6031	JOURNAL	Multi-disciplinary	1998	2013
Latindex	Latindex (regional system of online information for scientific journals in Latin America, the Caribbean, Spain and Portugal) is an information system which unifies and permits consultation of bibliographic information on serial scientific publications in the the regions mentioned (click here for more information). The journals included in the system by each participant country are evaluated in accordance with 33 quality criteria for printed journals or 36 for electronic journals.	http://www.latindex.org/		SEARCHABLE DATABASE		1997	2014
Learned Publishing	Learned Publishing is a major international journal, packed with the latest ideas and informed opinion to help you maximise new opportunities. The journal publishes 6-7 informed, topical articles in each issue plus reports on major initiatives and developments in the industry from around the world.	http://www.alpsp.org/Ebusiness/ResearchPublications/LearnedPublishing.aspx	1741 - 4857	JOURNAL	Scholarly Publishing		2014

Liquid journal of Complex Systems	The Liquid Jornal of Complex Systems was created by the Complex Systems Society in 2012 in order to provide an inexpensive and dynamic way for its members to disseminate their ideas. The term 'liquid publication' refers the possibility that publications can be changed, as developed by the European LiquidPub project. The Liquid Journal of Complex Systems implements a very simple form of this concept.	http://www.complexssociety.eu/liquid_journal_of_complex_systems.html		JOURNAL	Complex system	2012	2012
Living Reviews (and Living Review in Relativity, LRR)	Living Reviews are scientific open access journals, publishing review articles ... Its unique concept allows authors to regularly update their articles to incorporate the latest developments in the field. Living Reviews are available online only, enhanced by web features like movies, downloadable source code, or cross-linking to other resources	http://relativity.livingreviews.org/	1433 - 8351	JOURNAL SERIES	Relativity	1998	2014
Medical Education Online (MEO)	Medical Education Online (MEO) is a peer-reviewed international Open Access journal for disseminating information on the education and training of physicians and other health care professionals. It was launched in 1996 as the first ever freely available online journal in the field of medical education and has since then grown to become a highly ranked source of information in this area...	http://med-ed-online.net/index.php/meo/index	1087 - 2981	JOURNAL	Medical Education	1996	2014
Melissa Terras' Blog	Adventures in Digital Humanities and digital cultural heritage. Plus some musings on academia.	http://melissaterras.blogspot.com/		BLOG	Digital Humanities	2007	2014
Molecular INTeraction database (MINT)	Welcome to MINT, the Molecular INTeraction database. MINT focuses on experimentally verified protein-protein interactions mined from the scientific literature by expert curators. The full MINT dataset can be freely downloaded. The curated data can be analyzed in the context of the high throughput data and viewed graphically with the 'MINT Viewer'.	http://mint.bio.uniroma2.it/mint/Welcome.do		SEARCHABLE DATABASE	Protein Interaction	2002	2013
Molecules	A Journal of Synthetic Chemistry and Natural Product Chemistry. Molecules is the first peer-refereed chemistry journal supporting the deposit and exchange of samples. Published rapidly with free access at http://www.mdpi.org/molecules/, online monthly and CD-ROM yearly.	http://www.isuct.ru/khimia/molecules/	1420 - 3049	JOURNAL	Chemistry	1996	2014 (2003)

Multimodal Communication	Multimodal Communication sets out to open up a venue for researchers in diverse fields of study, who are broaching communication from an interdisciplinary perspective; for those who are exploring diverse and multimodal ways to conduct research and to illustrate findings.	http://multimodalcommunication.com/	2230 - 6587	JOURNAL	Multi disciplinary	2012	2013
Multimodal Literacy	The Multimodal Literacy Learning Community is interested in the representations of knowledge across different modes and meaning-making resources (eg. language, images, gestures). It promotes a systemic approach, stemming from Halliday's Systemic Functional Theory, to the analysis of media messages (eg. advertisements, online news, posters) so as to develop critical thinking and discourse analysis skills in students.	http://multimodalstudies.wordpress.com/		BLOG	Multimodal Literacy	2012	2012
Music and Anthropology (M&A)	Music and Anthropology (M&A) serves as a forum for studies which approach music as an essentially human and social expression. The journal is interdisciplinary and welcomes dialogue not only among the different fields of musical scholarship and the domains of social scientific scholarship, such as cultural and social anthropology, but also between music and psychology, folklore, feminist and gender studies and so forth.	http://www.levi.provincia.venezia.it/ma/index.htm	0312 - 2417	JOURNAL	Musical Studies	1996	2006
Music Theory Online (MTO)	Music Theory Online was launched experimentally in March 1993, after which issues 0.1 through 0.11 were published. Its permanent status was marked in January 1995 with the publication of Volume 1.1. MTO contains articles, commentaries on articles from previous issues, reviews, and essays all related to the field of professional music theory.	http://www.mtosmt.org/	1067 - 3040	JOURNAL	Musical Studies	1993	2014
Nature Precedings	Nature Precedings is a permanent, citable archive for pre-publication research and preliminary findings. Launched in 2007, Nature Precedings closed to new submissions in 2012. ... Nature Precedings has been a place for researchers to share documents, including presentations, posters, white papers, technical papers, supplementary findings, and non-peer-reviewed manuscripts. Documents on Nature Precedings have not been peer-reviewed and, as such, should not be considered "published" works.	http://precedings.nature.com/	1756 - 0357	REPOSITORY (Preprint)	Biomedical sciences, chemistry, and earth sciences.	2007	2012

New Horizons in Adult education	If you are interested in participating in an on-line discussion of articles in NEW HORIZONS, send your comments as an E-mail (AED_GSEJ@SUVM). We will then publish your remarks to all readers. Through electronic, forum-like dialogue, we hope to encourage communication and, at the same time, distill some of the problems and issues we encounter both as students and professionals in the field of adult education.	http://www.nova.edu/~aed/horizons/vol1n1	1939 - 4225	JOURNAL	Education	1987	2014
New Journal of Physics (NJP)	New Journal of Physics is an online-only, open-access, peer-reviewed scientific journal covering research in all aspects of physics, as well as interdisciplinary topics where physics forms the central theme.	http://iopscience.iop.org/1367-2630	1367 - 2630	JOURNAL	Physics	1998	2014
NewJour	NewJour is the place to announce your own (or to forward information about others') newly planned, newly issued, or revised ELECTRONIC NETWORKED journal or newsletter. ... NewJour represents an identification and road-mapping project for electronic journals and newsletters, begun by Michael Strangelove, University of Ottawa and carried on by the Association of Research Libraries as from 1993 to 2001.	http://gulib.georgetown.edu/newjour/		SEARCHABLE DATABASE	Online publication, journal and newsletters	1993	2014
Open Archive Initiative Resources (OAIster)	Millions of digital resources from thousands of contributors… OAIster is a union catalog of millions of records representing open access resources that was built by harvesting from open access collections worldwide using the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH). Today, OAIster includes more than 25 million records representing digital resources from more than 1,100 contributors.	http://oaister.worldcat.org/		SEARCHABLE DATABASE (Multimedia search engine, overlay journal)	Multi disciplinary	2002	2014
OpenStax Connexions (CNX)	Connexions is a place to view and share educational material made of small knowledge chunks called modules that can be organized as courses, books, reports, etc. ... We are a Web-based authoring ... It is a global repository of educational content …	http://cnx.org/		REPOSITORY (Ecosystem)	Education	1999	2014
ORBi	As well as being referenced, every article that has been published in journals by the members of ULg from 2002 onwards needs to be loaded onto ORBi. The author will permit open access to the full text of the documents each time that conditions allow him/her to do so.	http://orbi.ulg.ac.be/		REPOSITORY (Institutional)	Multi disciplinary	2007	2014

Palaeontologia Electronica (PE)	Palaeontologia Electronica (PE) is an open-access, peer-reviewed electronic journal covering all aspects of palaeontology. PE began publishing in 1998 and has been indexed in the Science Citation Index since 2005. PE complies with ICZN and ICBN regulations for the electronic publication of valid taxonomic names...	http://palaeo-electronica.org/content/	1094-8074	JOURNAL	Palaeontology	1998	2014
PeerJ	PeerJ is an Open Access publisher of scholarly articles. We aim to drive the costs of publishing down, while improving the overall publishing experience, and providing authors with a publication venue suitable for the 21st Century. Our tag line is: "Your Peers, Your Science. Academic Publishing Is Evolving" and we are committed to improving the process of scholarly publishing.	https://peerj.com/	2167-8359	JOURNAL	Biological and medical sciences	2013	2014
Philica	Philica is an online academic journal accepting publications on any subject. Philica takes a completely revolutionary approach to the publishing and reviewing of academic research.	http://www.philica.com/index.php	1751-3030	JOURNAL SERIES	Multidisciplinary	2006	2014
Physical Review Letters (PRL)	Today PRL is the world's foremost physics letters journal, providing rapid publication of short reports of significant fundamental research in all fields of physics. International in scope, the journal provides its diverse readership with weekly coverage of major advances in physics and cross disciplinary developments.	http://prl.aps.org/	1079-7114	JOURNAL	Physics		2014
Planet Math	PlanetMath is a virtual community which aims to help make mathematical knowledge more accessible. PlanetMath's content is created collaboratively: the main feature is the mathematics encyclopaedia with entries written and reviewed by members…	http://planetmath.org/		FORUM (Wiki)	Mathematics	1995	2014
Planned Obsolescence	Here's the main issue: obsolescence. A forum for exploring it, and for producing it. A space in which to think about the intimate interrelationship of new media and old media, and the ways in which newness and oldness are inevitably predicated on one another. This is—does it even need to be said?—a work in progress. I haven't a clue where it's going, but I'm looking forward to finding out.	http://www.plannedobsolescence.net/		BLOG	Media Studies	2002	2014

Press Forward	A free and open-source software project launched in 2011, PressForward enables teams of researchers to aggregate, filter, and disseminate relevant scholarship using the popular WordPress web publishing platform. Just about anything available on the open web is fair game: traditional journal articles, conference papers, white papers, reports, scholarly blogs, and digital projects.	http://pressforward.org/		AGGREGATOR (Publisher)	Natural sciences, social sciences, and humanities	2011	2014
Psycoloquy (or Hyper-Psyco loquy)	Psycoloquy is a refereed international, interdisciplinary electronic journal sponsored by the American Psychological Association (APA). Psycoloquy publishes target articles and peer commentary in all areas of psychology as well as cognitive science, neuroscience, behavioral biology, artificial intelligence, robotics/vision, linguistics and philosophy.	http://www.cogsci.ecs.soton.ac.uk/cgi/psyc/newpsy	1055-0143	JOURNAL	Psychology, cognitive science, neuro science, behavioural biology, artificial intelligence ...	1990	2002
Public Library of Science One (PLoS one)	PLOS ONE (eISSN-1932-6203) is an international, peer-reviewed, open-access, online publication. PLOS ONE welcomes reports on primary research from any scientific discipline. It provides: a) Open-access—freely accessible online, authors retain copyright, b) Fast publication times, c) Peer review by expert, practicing researchers, d) Post-publication tools to indicate quality and impact, e) Community-based dialogue on articles, f) Worldwide media coverage.	http://www.plosone.org/home.action	1932-6203	JOURNAL	Multi disciplinary	2006	2014
PubMed	PubMed comprises more than 24 million citations for biomedical literature from MEDLINE, life science journals, and online books. Citations may include links to full-text content from PubMed Central and publisher web sites.	http://www.ncbi.nlm.nih.gov/pubmed		SEARCHABLE DATABASE	Life Sciences, biomedical studies	1996	2014
PubZone	PubZone provides a discussion forum for publications in the database community. The idea is to provide an open platform in order to discuss publications, upload extra material (e.g., experimental results, PowerPoint presentations) and rate publications and comments about publications.	http://www.pubzone.org/		FORUM	Multidisciplinary		2014
Push	Push is a journal dedicated to publishing original research on writing with source code.	http://push.cwcon.org/		JOURNAL	Multi disciplinary		

Recons truction	Whether or not we have reached the nadir of postmodernism, it has become evident that what is required of thinkers is an attempt to rebuild after the destructive nihilism of postmodern apathy. Much like the American South after the Civil War, it is a time of reflection and forward thinking: For those of us who care about the future, there is the obvious need to work towards something, and with time, thought and effort, Reconstruction should help to affect such an end.	http://reconstruction.eserver.org/	1547 - 4348	JOURNAL	Contemporary culture	2001	2013
Rejecta Mathematica	Rejecta Mathematica is an open access, online journal that publishes only papers that have been rejected from peer-reviewed journals (or conferences with comparable review standards) in the mathematical sciences. At Rejecta Mathematica we believe that many previously rejected papers (even those rejected for legitimate reasons) can nonetheless have a very real value to the academic community.	http://math.rejecta.org/	1948 - 8351	JOURNAL	Mathematics	2009	2011
Research Activities	Research Activities is a digest of research findings that have been produced with support from the Agency for Healthcare Research and Quality (AHRQ). Research Activities is published by AHRQ's Office of Communications and Knowledge Transfer.	http://www.ahrq.gov/research/resact.htm		AGGREGATOR (Newsletter, Digest)	Healthcare Research	1995	2010
Research Blogging	Do you like to read about new developments in science and other fields? Are you tired of "science by press release"? ResearchBlogging.org is your place. ResearchBlogging.org allows readers to easily find blog posts about serious peer-reviewed research, instead of just news reports and press releases.	http://researchblogging.org/post-list/list/date/all		AGGREGATOR (Blog)	Science and other fields	2007	2014
Retraction Watch	So why write a blog on retractions? First, science takes justifiable pride in the fact that it is self-correcting — most of the time. Usually, that just means more or better data, not fraud or mistakes that would require a retraction. But when a retraction is necessary, how long does that self-correction take? ... Second, retractions are not often well-publicized. ... Third, they're often the clues to great stories about fraud or other malfeasance... Finally, we're interested in whether journals are consistent.	http://retractionwatch.wordpress.com/		BLOG	Multi-disciplinary	2010	2014
Revista de Enfermedades Infecciosas en Pediatría	La Revista de Enfermedades Infecciosas en Pediatría es el Órgano Oficial de la Asociación Mexicana de Infectología Pediátrica (AMIP) y de la Sociedad Latinoamericana de Infectología Pediátrica (SLIPE), que pone a disposición del médico información innovadora y actual.	http://www.enfermedadesinfecciosas.com/revista.php	1405 - 0749	JOURNAL	Paediatrics	2006	2014

Rhetnet	RhetNet is a concerted effort to see what publishing on the net might be in its "natural" form. Without leaving our print heritage behind entirely, we want to adapt to the net rather than only adapting net publishing to print-based convention. ... Rhetnt-l@mizzou1.missouri.edu is an open discussion list which serves as a means of disseminating RhetNet information and texts, but it is also a forum for discussing the specific shape of the journal and issues surrounding electronic publication in general.	http://wac.colostate.edu/rhetnet/		JOURNAL	Rhetoric	1995	1997
Rights MEtadata for Open archiving (SHERPA/ RoMEO))	Provides a searchable database of publishers' copyright and selfarchiving policies for pre-prints and post-prints.	http://www.sherpa.ac.uk/romeo/index.php?fIDnum=|&mode=simple&la=en		SEARCHABLE DATABASE		2002	2014
Scholarly Open Access	My interest in scholarly open-access publishing began in 2009 when I reviewed the publisher Bentham Open in The Charleston Advisor, a journal that reviews electronic resources.	http://scholarlyoa.com/		BLOG	Scholarly publishing	2012	2014
Scielo	SciELO is an electronic library covering a selected collection of Brazilian scientific journals... The objective of the site is to implement an electronic virtual library, providing full access to a collection of serial titles, a collection of issues from individual serial titles, as well as to the full text of articles. The access to both serial titles and articles is available via indexes and search forms.	http://www.scielo.br/		SEARCHABLE DATABASE		1997	2014
Science in the Open	This site is a place for me to think through the technical problems and issues involved in electronically recording our work for publication on the web and the other social and logistical issues that are raised by making the science we do more immediately available and more connected to the world outside the laboratory.	http://cameronneylon.net/		BLOG	Open Research	2007	2014

Science Today	Science Today is the California Academy of Sciences' channel for current stories on cutting-edge technologies, life, Earth, space and sustainability. Content is produced in-house and is distributed throughout the museum, on the internet and through various partners. Please share your comments on what you find important in the changing world of science.	http://www.calacademy.org/sciencetoday/		SERVICE (CHANNEL)	Earth, Life, Space, Sustainability, Technology		2014
SciVee	SciVee is a science video sharing website where researchers can upload, view and share science video clips and connect them to scientific literature, posters and slides.	http://www.scivee.tv/		SERVICE (Video sharing website)	Multidisciplinary	2007	2014
Semantic Web (SWJ)	SWJ – Interoperability, Usability, Applicability (published and printed by IOS Press...) brings together researchers from various fields which share the vision and need for more effective and meaningful ways to share information across agents and services on the future internet and elsewhere. As such, Semantic Web technologies shall support the seamless integration of data, on-the-fly composition and interoperation of Web services, as well as more intuitive search engines.	http://www.semantic-web-journal.net/	1570-0844	JOURNAL	Semantic Web	2010	2014
SemioTix New Series	SemiotiX New Series is a global information bulletin. Its aim is to provide periodic snapshots of the situation of semiotic research in the world, with photos, editorials by, and profiles of, active semioticians, mini-reviews of books, state-of-the-arts at a glance, and selective publicizing of scholarly events.	http://www.semioticon.com/semiotix/	1916-7296	JOURNAL (Bulletin)	Social Semiotics	2010	2013
Sociological Research Online	We publish fully peer-reviewed sociology looking at current issues. A purely online journal, we make use of new media and reach a wide and international readership. We also publish special sections and rapid response articles, which address key issues in the public arena.	http://www.socresonline.org.uk/home.html	1360-7804	JOURNAL	Sociology	1996	2014
Solstice	Published twice annually since 1990 by the Institute of Mathematical Geography. Original (peer-reviewed) articles, invited articles, notes, and reprints.	http://www.mylovedone.com/image/solstice/SolsticeDec2011.html	1059-5325	JOURNAL	Geography, Mathematics	1990	2013

Southern Spaces	Southern Spaces is a peer-reviewed, multimedia, open-access journal. We publish articles, photo essays and images, reviews, presentations, and short videos about real and imagined spaces and places of the U.S. South and their global connections... Southern Spaces combines innovative scholarship about real and imagined spaces and places of the American South with the tools of digital media.	http://southernspaces.org/	1551 - 2754	JOURNAL	Multi disciplinary	2004	2014
Teachers College Record	The Teachers College Record is a journal of research, analysis, and commentary in the field of education. It has been published continuously since 1900 by Teachers College, Columbia University.	http://www.tcrecord.org/	0161 - 4681	JOURNAL	Education	1990	2014
The AAPS [American Association of Pharma ceutical Scientists] Journal	The AAPS Journal (ISSN 1550-7416) is a peer-reviewed online-only journal owned by the American Association of Pharmaceutical Scientists. The journal covers all areas of pharmaceutical research, except pharmaceutical technology and engineering, which are covered by its sister journal, AAPS PharmSciTech (http://www.aapsj.org/about/default.asp)	http://www.pharmagateway.net/AAPSJournal	1550 - 7416	JOURNAL	Pharma ceutical research	1999	2014
The B.E Journal of Theoretical Economics (BEJTE)	The B.E. Journal of Theoretical Economics (BEJTE) welcomes submissions in all areas of economic theory, both applied and "pure" theory. Contributions can be either innovations in economic theory or rigorous new applications of existing theory.	http://www.degruyter.com/view/j/bejte?rskey=aiDwun&result=1&q=theoretical%20e	1935 - 1704	JOURNAL	All areas of economic theory	2001	2014
The British Medical Journal (BMJ)	The BMJ (British Medical Journal) is an international peer reviewed medical journal and a fully “online first” publication. Our "continuous publication" model means that all articles appear on bmj.com before being included in an issue of the print journal. The website is updated daily with the BMJ’s latest original research, education, news, and comment articles, as well as podcasts, videos, and blogs.	http://www.bmj.com/	1756 - 1833	JOURNAL	Medical Studies	1995	2014

The Electronic Journal of Communication (EJC/REC)	The Electronic Journal of Communication / La Revue Electronic de Communication launched in 1990 as one of the first five peer reviewed electronically distributed scholarly journals in world history and the first ever in the social sciences. EJC/REC is devoted to the study of communication theory, research, practice, and policy.	http://www.cios.org/www/ejcmain.htm	1183-5656	JOURNAL	Communication theory, research, practice, and policy	1990	2013
The Future of Scientific Publishing	This Blog explores ideas for the future of scientific publishing. I feel that the current system is unsatisfactory in many respects and retains its current form not because it is near optimal, but because of its historical development in the pre-internet era and because it provides large profits to the publishing industry. The internet allows for a more open, transparent, objective, powerful, and cost-efficient system. The first step toward the realization of an alternative is to imagine it.	http://futureofscipub.wordpress.com/		BLOG	Scientific publishing	2009	2014
The Journal for Multi Media History (JMMH)	The JMMH is the first peer-reviewed electronic journal that presents, evaluates, and disseminates multimedia historical scholarship. ... (JMMH) presents multimedia historical articles and explores how radio, television, CD-ROM/DVD technologies, World Wide Web (WWW) hypertext documents, Internet radio and video, and a variety of other multimedia applications are transforming and expanding the possibilities for research, documentation, and dissemination of historical scholarship.	http://www.albany.edu/jmmh/	1528-3844	JOURNAL	History	1998	2000
The Journal of Electronic Publishing (JEP)	The Journal of Electronic Publishing (JEP) is a forum for research and discussion about contemporary publishing practices, and the impact of those practices upon users. ... JEP aspires to document changes in publishing, and in some cases to stimulate and shape the direction of those changes. The articles present innovative ideas, best practices, and leading-edge thinking about all aspects of publishing, authorship, and readership.	http://www.journalofelectronicpublishing.org/	1080-2711	JOURNAL	Contemporary publishing practices	1995	2014
The Journal of Undergraduate Multimedia Project (TheJUMP)	The Journal of Undergraduate Multimedia Projects is an electronic journal dedicated to 1) providing an outlet for the excellent and exceedingly rhetorical digital/multimedia projects occurring in undergraduate courses around the globe, and 2) providing a pedagogical resource for teachers working with (or wanting to work with) "new media".	http://jump.cwrl.utexas.edu/		JOURNAL	Multimedia & Digital Studies	2010	2012

The New England Journal of Medicine (NEJM)	The New England Journal of Medicine (NEJM.org) is dedicated to bringing physicians the best research and key information at the intersection of biomedical science and clinical practice, and to presenting the information in an understandable and clinically useful format.	http://www.nejm.org/	1533 - 4406	JOURNAL	Medicine	2010	2014
The New Everyday	The New Everyday is a web publication that exists "between a blog and a journal," also known as "middle state" publishing. It's a chance to learn what you think by writing and then get feedback from the Media Commons community as part of the process of developing your ideas. The purpose of this Media Commons project is to investigate the everyday in the era of globalized digital media.	http://mediacommons.futureofthebook.org/tne/		BLOG (Middle state publishing platform)	Everyday life	2012	2014
The Public Journal of Semiotics (PJOS)	This site is designed to publish substantial articles that contribute to the advancement of semiotic research in a wide range of disciplines. It also endeavors to provide an outlet for works that rely on the resources of several disciplines to address theoretical issues or solve practical problems in a manner consistent with the highest standards of scientific research.	http://pjos.org/?k=current_issue	1918 - 9907	JOURNAL	Semiotic Research	2007	2014
The Scholar Electric	Blogging the intersections of digital scholarship, new media, and emerging publishing technologies for the Computers and Composition Digital Press	http://www.ryantrauman.net/scholarelectric/		BLOG	Digital publishing, New media scholarship & writing technologies	2011	2014
The Scholarly Kitchen	The mission of the Society for Scholarly Publishing is "[t]o advance scholarly publishing and communication, and the professional development of its members through education, collaboration, and networking." The Scholarly Kitchen is a moderated and independent blog aimed to help fulfill this mission by bringing together differing opinions, commentary, and ideas, and presenting them openly.	http://scholarlykitchen.sspnet.org/		BLOG	Scholarly Publishing and communication	2008	2014

The Stoa Consortium for Electronic Publication in the Humanities	The Stoa Consortium for Electronic Publication in the Humanities has been edited since its creation in 1997 by Ross Scaife,... Several purposes: dissemination of news and announcements, mainly via the gateway blog; discussion of best practices via discussion groups and white papers; and publication of experimental on-line projects, many of them subject to scholarly peer review. Open Access to networked scholarship is a bedrock principle for this site.	http://www.stoa.org		BLOG	Electronic scholarship in the humanities	2003	2014
ThoughtMesh	ThoughtMesh is an unusual model for publishing and discovering scholarly papers online. It gives readers a tag-based navigation system that uses keywords to connect excerpts of essays published on different Web sites.	http://thoughtmesh.net/		AGGREGATOR (Tool)	Scholarly Publishing and communi-cation	2005	2014
UCSD Signaling Gateway	The UCSD Signaling Gateway is a useful resource for anyone interested in signal transduction. This Gateway is designed to facilitate navigation of the complex world of research into cellular signaling. … Signal transduction discoveries are being made at an ever-increasing rate. Tens of thousands of papers are published annually... The Signaling Gateway, a comprehensive and free online resource ...	http://www.signaling-gateway.org/		SEARCHABLE DATABASE	Celular signaling	2001	2014
ULAM Quarterly	The Ulam Quarterly began in 1992 motivated by the belief that the dissemination of ideas in mathematics has to keep up with the technology of mathematics. We believe we were the first electronic journal available on the Internet. At that time, the goal was to produce a journal in which the tex files ... This was in part necessary because of the difficulty many sites experienced in downloading the large PostScript files. Indeed, graphics were not part of the old technology.	http://www.ulam.usm.edu/	1068-6010	JOURNAL	Mathematics	1992	1996
UlrichsWeb Global Serials Directory	The Global Source for Periodicals ... Ulrichsweb Global Serials Directory is an important tool for reference, research, and serials management. This database provides information on virtually every active and ceased periodical, annual, irregular publication, and monographic series published throughout the world, plus thousands of newpapers.	http://ulrichsweb.serialssolutions.com	0000-0175 & 0000-2100	SEARCHABLE DATABASE		?	2014

Vectors	Vectors maps the multiple contours of daily life in an unevenly digital era ... of our increasingly technologically-mediated existence. ... Operating at the intersection of culture, creativity, and technology, the journal focuses on the myriad ways technology shapes, transforms, reconfigures, and/or impedes social relations, both in the past and in the present.	http://vectorsjournal.org/journal/index.php?page=Introduction		JOURNAL	Multi disciplinary	2005	2013
vertigO	Fondé en 2000, VertigO est une revue scientifique interdisciplinaire de sciences naturelles et de sciences humaines dont les articles sont soumis aux règles usuelles d'évaluation par un comité de pairs. Elle assure la promotion et la diffusion au sein de la francophonie de recherches et d'analyses scientifiques sur les grands problèmes environnementaux contemporains.	http://vertigo.revues.org/	1492 - 8442	JOURNAL	Environment	2000	2013
Video Journal of Semantic Data Management	The Video Journal of Semantic Data Management represents an innovative and multimedial way of publishing and sharing current research in the area of Semantic Data Management. It calls for presentations on original and high-quality research describing the role of Semantic Web technologies, Linked Data, and ontologies for the Data Management.	http://videolectures.net/semantic_data_management_video_journal_vol1/		JOURNAL (Video journal, Channel)	Semantic data management	2012	2013
Virtual Reality Laboratory Archive (VRL)	The University of Michigan Virtual Reality Laboratory (VRL) at the College of Engineering was founded in 1993 and closed its doors in 2008 with the retirement of its founder and director Klaus-Peter Beier. During its 15 years of operation, the Lab was involved in research and development projects that explored innovative applications of immersive and non-immersive virtual environments, some of them being preserved in this Archive for interested audiences.	http://www-vrl.umich.edu/		REPOSITORY	Virtual Reality	1993	2008
Visible Language	So what is visible language? It is the typefaces, glyphs, word-image equations, signs, color codes, emoticons, websites, books, diagrams, concrete poetry, icons, movie trailers, letterforms, punctuation, grids, navigation, search and find (or not), television graphics, word art, symbols, notations systems, texts and visible patterns. It is interaction of perception, cognition, emotion, and contexts that help form and inform our lives.	http://visiblelanguagejournal.com/	0022 - 2224	JOURNAL	Communication Design, Anthropology, Art, Design, Education, English and Linguistics		2014

Visual Anthropology Review	Visual Anthropology Review presents research on visual studies, broadly conceived. Within its scope, the journal encompasses both the study of visual aspects of human behavior and the use of visual media in anthropological research, representation and teaching. Visual Anthropology Review is an essential publication for scholars of visual and cultural anthropology as well as students and professionals in fine arts, performing arts, design and communication.	http://onlinelibrary.wiley.com.proxy.bnl.lu/journal/10.1111/%28ISSN%291548-7458	1548 - 7458	JOURNAL	Anthropology		2013
VPIEJ-L	VPIEJ-L is a discussion list for electronic publishing issues, especially those related to Scholarly Electronic Journals. … One goal of the list is to provide better feedback from users to creators, so we are very interested in receiving and archival issues. ... Current readers of and contributors to VPIEJ-L have discussed readability and screen display, copyright, and advertising (noncommercial).	http://scholar.lib.vt.edu/ejournals/vpiej-l/vpiej-l.resource.html		FORUM (Discussion List)	Electronic publishing issues	1997	1995
World mapper	The maps and data files cover 200 territories, mainly United Nation Member States plus a few others to include at least 99.95% of the world's population.	http://www.worldmapper.org		REPOSITORY (Thematic database)	Demographic, Population	2006	2014
Wulfenia Journal [???]	Wulfenia (ISSN: 1561-882X) is a multi-disciplinary, peer-reviewed international ISI journal for publication of novel ideas, the state-of-the-art research results and fundamental advances in all aspects of theoretical and applied topics in science and engineering including areas in natural and social sciences. [???]	http://www.multidisciplinarywulfenia.org/about/index.html	1561 - 882X (???)	JOURNAL (but..)	Multi disciplinary		

Appendix 2: First Sample - 38 Selected Journals with Multimedia Content

Name	AAPSJ [The AAPS Journal]	ACP [Atmospheric Chemistry and Physics]	AIP [AIP Advances]
Profile [Subtitle]	The American association of pharmaceutical scientists journal	An interactive open access journal of the European geosciences union	
Profile [ISSN]	1550-7416	1680-7316	2158-3226
Profile [First and last published online Issue]	1999 - 2014	2001 - 2014	2011 - 2012 (2014)
Profile [Disciplines [Focus]	Sciences [Pharmaceutical research]	Sciences [Geosciences]	Sciences [Physical Sciences]
Journal level: Website Homepage [Semiotic resource]	None	None	None
Journal level: Multimedia Section	None	None	Yes (Media) [= Videos and Podcasts with author interviews, last one in 2011]
Article level: Supplementary material	Yes [but rare. 2 research articles with .doc]	Yes (Supplementary Information)	None
Article and/or Journal level: Functionalities and/or Interactivity	None	Yes (Interactive Discussion)	Yes (Post-publication rating and commenting)
Article level: Semiotic resources (None, rare, frequent, systematic)	None [Conventional, no clickable image]	None [Conventional, Tables and Figures]	None
Scientific (research) article: promoted format(s)	Article	Article, Paper (+ Discussion paper, Enhanced PDF)	Article
Article example	None	None	None
Highlights	New platform (Springer)	Open Access, Public Peer-Review, Interactive Public Discussion, Transparent post-discussion review	OUTDATED (Twitter, iResearch - Iphone, Ipad, Ipod)

Name	BG [Biogeosciences]	BJ [Biochemical Journal]	BMJ [The British Medical Journal]
Profile [Subtitle]	An interactive open access journal of the European geosciences union		Helping doctors make better decisions
Profile [ISSN]	1726-4170	1470-8728	1756-1833
Profile [First and last published online Issue]	2004 - 2014	1999 - 2014	1995 - 2014
Profile [Disciplines [Focus]	Sciences [Bio-geo-sciences]	Sciences [Biochemistry, Cellular and molecular biology]	Sciences [Medical Studies]
Journal level: Website Homepage [Semiotic resource]	None	None	Yes (Slideshow)
Journal level: Multimedia Section	None	Yes (Podcast (Listen to XX discussing her latest paper)	Yes (Multimedia) [=Podcast]
Article level: Supplementary material	Yes (Original paper, interactive comments, final revised paper)	Yes (Online Data)	None
Article and/or Journal level: Functionalities and/or Interactivity	Yes (Scientific discussion forum, Interactive public discussion)	Yes (Utopia Document) [Reading Tool]	Yes (Rapid Responses) [e-letters to the journal]
Article level: Semiotic resources (None, rare, frequent, systematic)	None	Frequent [Podcast, Multimedia, Online Data, Interactive structures]	None [Conventional, Tables and Figures]
Scientific (research) article: promoted format(s)	Article, Paper	Classic article	Articles, Paper
Article example	None	None	None
Highlights	Open Access. Public Peer-Review	Multimedia adjuncts. Knowledge environments.	

Name	CCO [Computers and Composition Online]	CEC [CrystEngComm]	CEL [Currents in Electronic Literacy]
Profile [Subtitle]		Design and understanding of solid-state and crystalline materials	
Profile [ISSN]	1873-2011	1466-8033	1524-6493
Profile [First and last published online Issue]	2003 - 2014	1999 - 2014	1999 - 2014
Profile [Disciplines [Focus]	Humanities [Teaching of language, Literacy]	Sciences [Crystal engineering research]	Humanities [Electronic Literacy]
Journal level: Website Homepage [Semiotic resource]	None	None	None
Journal level: Multimedia Section	None	None	None
Article level: Supplementary material	None	None	None
Article and/or Journal level: Functionalities and/or Interactivity	None	Yes (Rich HTML)	None
Article level: Semiotic resources (None, rare, frequent, systematic)	Systematic	? [Accessibility]	Rare [Audio]
Scientific (research) article: promoted format(s)	Web-aware submission	Article (Rich HTML, PDF)	Article (www publication format)
Article example	None	None	None
Highlights		"A graphical abstract is available for this content"	

Name	CITE [Contemporary Issues in Technology and Teacher Education]	CJO [Crystallography Journals Online]	EIJ [Earth Interactions Journal]
Profile [Subtitle]			Exploring the interactions among the biological, physical, and human components of the earth system
Profile [ISSN]	1528-5804	2053-2733	1087-3562
Profile [First and last published online Issue]	2000 - 2014	1999 - 2014	1997 - 2014
Profile [Disciplines [Focus]	Social sciences [Teacher education]	Sciences [Crystallography]	Sciences [Geophysics (interdisciplinary)]
Journal level: Website Homepage [Semiotic resource]	None	None	None
Journal level: Multimedia Section	None	None	None
Article level: Supplementary material	None	Yes	None
Article and/or Journal level: Functionalities and/or Interactivity	Yes (Formal commentary)	Yes [Highlighted articles]	None
Article level: Semiotic resources (None, rare, frequent, systematic)	Rare [None in the current issue and in the last 2013 issues]	? [Accessibility]	None [Conventional, Clickable figures and tables]
Scientific (research) article: promoted format(s)	Article, Paper	Article (+ Enhanced figures, 3D view)	Paper
Article example	None	Sample Issue	None
Highlights	"A scholarly adventure, a departure from the traditional print journal)"		Dynamic and interactive components

Name	EJGE [Electronic Journal of Geotechnical Engineering]	ENCULTU [Enculturation]	EPAA [Education Policy Analysis Archives]
Profile [Subtitle]	The world wide web of geotechnical engineers (W3G)	A journal of rhetoric, writing and culture	A peer-reviewed, independent, open-access, multilingual journal
Profile [ISSN]	1089-3032	1525-3120	1068-2341
Profile [First and last published online Issue]	1996 - 2014	1997 - 2014	1993 - 2014
Profile [Disciplines [Focus]	Sciences [Geotechnical Engineering]	Humanities [Rhetoric, Writing, Culture]	Social sciences [Education Policies]
Journal level: Website Homepage [Semiotic resource]	None	None	Yes (Video)
Journal level: Multimedia Section	Yes (EJGE Magazine Room)	None	Yes (Blog) [audio or video podcast and comment]
Article level: Supplementary material	None	None	None
Article and/or Journal level: Functionalities and/or Interactivity	None	None	Yes (Comment) [in Blog]
Article level: Semiotic resources (None, rare, frequent, systematic)	None	Frequent [Audio, Video, Others]	None
Scientific (research) article: promoted format(s)	Paper	Article, Project, Review	Article
Article example	None	None	None
Highlights			Multilingual

Name	FNS [Fertility and Sterility]	FRONTIERS [Frontiers Journal Series]	IA [Internet Archaeology]
Profile [Subtitle]		High quality open access publishing and research networking	The premier e-journal for archaeology
Profile [ISSN]	0015-0282	XXXX-XXX (a different ISSN for every journal)	1363-5387
Profile [First and last published online Issue]	2012 - 2014	2007 - 2014	1996 - 2014
Profile [Disciplines [Focus]	Sciences [Medical]	Sciences [STM]	Sciences [Archaeology]
Journal level: Website Homepage [Semiotic resource]	Yes (Video)	Yes (Slideshow)	None
Journal level: Multimedia Section	Yes (Author Interview Videos, Journal Club Live)	Yes (Videos, Images)	None
Article level: Supplementary material	None	None	None
Article and/or Journal level: Functionalities and/or Interactivity	Yes (Discuss,What I'm reading)	Yes (Interactive Review Forum)	None
Article level: Semiotic resources (None, rare, frequent, systematic)	None	None	Frequent
Scientific (research) article: promoted format(s)	Article, Video Article (+ Capsule: presentation of an article in 3/5 lines)	Article (+ e.Document)	Article (web document)
Article example	Original Video Article	None	None
Highlights			Hybrid Open-Access Journal

Name	IMR [In Media Res]	IPOL [Image Processing On Line]	JAMS [Journal of the American Musicological Society]
Profile [Subtitle]	A media commons project		
Profile [ISSN]	No	2105-1232	1547-3848
Profile [First and last published online Issue]	2006 - 2014	2011 - 2014	? - 2014
Profile [Disciplines [Focus]	Humanities [Online scholarship]	Sciences [Image Analysis]	Humanities [Musical Studies]
Journal level: Website Homepage [Semiotic resource]	None	None	None
Journal level: Multimedia Section	None	None	Yes (Digital and Multimedia Scholarship)
Article level: Supplementary material	None	Yes (Source code)	Yes
Article and/or Journal level: Functionalities and/or Interactivity	Yes (Feedback)	Yes (Demo)	None
Article level: Semiotic resources (None, rare, frequent, systematic)	Systematic [VideoText]	Systematic [Demo]	Frequent
Scientific (research) article: promoted format(s)	3-minute video clip/visual image slideshow accompanied by a 300-350-word impressionistic response	Article (with Online demonstration facility)	Article
Article example	None	None	None
Highlights	Video Curator		Enhancements

Name	JAR [Journal for Artistic Research]	JASA-EL [Journal of the Acoustical Society of America Express Letters]	JCS [Journal of Cell Science]
Profile [Subtitle]			
Profile [ISSN]	2235-0225	0001-4966	1477-9137
Profile [First and last published online Issue]	2011 - 2014	1998 - 2014	2000 - 2014
Profile [Disciplines [Focus]	Humanities [Artistic research]	Humanities [Acoustics]	Sciences [Cell Biology]
Journal level: Website Homepage [Semiotic resource]	None	None	None
Journal level: Multimedia Section	None	None	Yes (Cell Science at a glance, Posters)
Article level: Supplementary material	None	None (Tab "Data and Media")	Yes [combined with section "At a glance" and section "Poster" to be downloaded)
Article and/or Journal level: Functionalities and/or Interactivity	Yes (Reviewer comment)	None	None
Article level: Semiotic resources (None, rare, frequent, systematic)	Systematic [Multi-modal Exposition]	None	None
Scientific (research) article: promoted format(s)	Exposition	Letter	Poster article
Article example	None	None	None
Highlights			Community Journal

Name	JoVE [Journal of Visualized Experiments]	JSAH [Journal of the Society of Architectural Historians]	KAIROS [Kairos]
Profile [Subtitle]	The first scientific video journal	The leading journal on the built environment	A journal of rhetoric, technology and pedagogy
Profile [ISSN]	1940-087X	2150-5926	1521-2300
Profile [First and last published online Issue]	2006 - 2014	2010 - 2014	1996 - 2014
Profile [Disciplines [Focus]	Sciences [Biology, Medical studies, Chemistry, Physics]	Humanities [Architectural history]	Humanities [Rhetoric, Technology, Pedagogy]
Journal level: Website Homepage [Semiotic resource]	Yes (Video)	Yes (Video)	None
Journal level: Multimedia Section	None	None	None
Article level: Supplementary material	None	None	None
Article and/or Journal level: Functionalities and/or Interactivity	Yes (Rating, commenting)	None	None
Article level: Semiotic resources (None, rare, frequent, systematic)	Systematic [Video article]	Frequent	Systematic [Webtext]
Scientific (research) article: promoted format(s)	Video Article	Article (with label Multimedia)	Webtext
Article example	None	Sample Article	None
Highlights		Multimedia and Website Review Editor	

Name	LRR [Living Reviews in Relativity]	MTO [Music Theory Online]	NEJM [The New England Journal of Medicine]
Profile [Subtitle]		A journal of the society for music theory	
Profile [ISSN]	1433-8351	1067-3040	1533-4406
Profile [First and last published online Issue]	1998 - 2014	1993 - 2014	2010 - 2014
Profile [Disciplines [Focus]	Sciences [Relativity]	Humanities [Musical Studies]	Sciences [Medicine]
Journal level: Website Homepage [Semiotic resource]	None	None	None
Journal level: Multimedia Section	None	None	Yes (Multimedia and Images) [= Video, Video roundtable, Interview, Other video]
Article level: Supplementary material	None	None	None
Article and/or Journal level: Functionalities and/or Interactivity	Yes (Downoad) [HTML archive for offline reading]	None	None
Article level: Semiotic resources (None, rare, frequent, systematic)	None	Frequent [Videos, Audio]	Frequent [Audio interview, Audio summary]
Scientific (research) article: promoted format(s)	Hypertext document	Article	Article
Article example	None	None	None
Highlights	Hypertext Journal. Off-line reading. User-oriented (and not reader oriented)	1993, First Issue	Online first. See "Browse figures and multimedia"

Name	NJP [New Journal of Physics]	PA [Palaeontologia Electronica]	PHILICA [Philica]
Profile [Subtitle]	The open access journal at the forefront of physics		Where ideas are free. The instant, open-access journal of everything
Profile [ISSN]	1367-2630	1094-8074	1751-3030
Profile [First and last published online Issue]	1998 - 2014	1998 - 2014	2006 - 2014
Profile [Disciplines [Focus]	Sciences [Physics]	Sciences [Palaeontology]	Humanities, Sciences, Social sciences [Multidisciplinary]
Journal level: Website Homepage [Semiotic resource]	None	None	None
Journal level: Multimedia Section	Yes (Video Abstract)	Yes (Blog)	None
Article level: Supplementary material	None	None	None
Article and/or Journal level: Functionalities and/or Interactivity	None	None	None
Article level: Semiotic resources (None, rare, frequent, systematic)	Frequent [Video]	None	None
Scientific (research) article: promoted format(s)	Article (+ Video Abstract)	Article	Article
Article example	None	None	None
Highlights		Animations in the first issues published	Journal of everything

Name	REIP [Revista de Enfermedades Infecciosas en Pediatría]	SRO [Sociological Research Online]	SSP [Southern Spaces]
Profile [Subtitle]			An interdisciplinary journal about regions, places, and cultures of the u.s. south and their global connections
Profile [ISSN]	1405-0749	1360-7804	1551-2754
Profile [First and last published online Issue]	2006 - 2014	1996 - 2014	2004 - 2014
Profile [Disciplines [Focus]	Sciences [Pediatria]	Social sciences [Sociology]	Humanities [Interdisciplinary [Cultural studies]]
Journal level: Website Homepage [Semiotic resource]	None	None	None
Journal level: Multimedia Section	Yes (Audio interview)	None	Yes (Articles, Photo Essays, Presentations, Short Videos, Featured Images)
Article level: Supplementary material	None	None	None
Article and/or Journal level: Functionalities and/or Interactivity	None	Yes (Pinboard) [outdated]	None
Article level: Semiotic resources (None, rare, frequent, systematic)	None	None	Frequent
Scientific (research) article: promoted format(s)	Article	Article	Article, Photo Essay, Presentation, Short Video, Featured Image
Article example	None	None	None
Highlights	Mexico		Multimedia Journal

Name	TCR [Teachers College Record]	VECTORS [Vectors]	
Profile [Subtitle]	The voice of scholarship in education	Journal of culture and technology in a dynamic vernacular	
Profile [ISSN]	0161-4681	No	
Profile [First and last published online Issue]	1990 - 2014	2005 - 2013	
Profile [Disciplines [Focus]	Social sciences [Education]	Social sciences [Multidisciplinary]	
Journal level: Website Homepage [Semiotic resource]	None	None	
Journal level: Multimedia Section	Yes (The voice)	None	
Article level: Supplementary material	None	None	
Article and/or Journal level: Functionalities and/or Interactivity	Yes (Commentary, Discussion) [sections]	Yes (Interactive Statement)	
Article level: Semiotic resources (None, rare, frequent, systematic)	None	Systematic [Project]	
Scientific (research) article: promoted format(s)	Article	Project (Multimedia works, Multimedia projects)	
Article example	None	None	
Highlights		SCALAR + Fellowship competition that brings together recipients for a summer residency.	

Appendix 3: Editorial Policy of the 38 Selected Journals with Multimedia Content

Name	About the journal [from the website of the Journal]	Submission guidelines - the multimodal format [From the website of the Journal]	Supplementary information [Wikipedia, Blog post, Press release, Editorial etc.]
AAPSJ [The AAPS Journal]	The AAPS Journal is an online-only journal publishing peer-reviewed scholarly reviews, themed issues and research articles within the entire scope of the pharmaceutical sciences encompassed by the AAPS membership. The Journal particularly aims to foster the dissemination of scientific information presented at AAPS-sponsored meetings, workshops and symposia, through the publication of invited reviews in themed issues.		Special Features, Appendices and Supplementary Material ... can be accommodated and may contain highly interactive features or large databases. All authors are encouraged to take full advantage of the Web-only capabilities of online publishing, including 3-D, video, and interactive graphics. If a desired technical feature is not covered in the Author's Instructions, please contact ... (AAPSJ n.d.)
ACP [Atmospheric Chemistry and Physics]	Atmospheric Chemistry and Physics is an open access publication of the European Geosciences Union. It is a peer-reviewed scientific journal publishing studies investigating the Earth's atmosphere and the underlying chemical and physical processes. ... Atmospheric Chemistry and Physics has an innovative two-stage publication process involving the scientific discussion forum Atmospheric Chemistry and Physics Discussions (ACPD), which has been designed	Supplementary material, such as data sets, animated visualisation, etc., should be submitted together with the manuscript for peer-reviewed publication (General Guidelines for Manuscripts & Submission) + Copernicus Publications recommends depositing data that correspond to journal articles in reliable data repositories, assigning digital object identifiers, and properly citing a data set as a proper citation. Please find your appropriate data repository in the Registry for Research Data Repositories re3data.org or in Databib (Data Policy)	Was this caution about open review an attempt to avoid throwing out the baby of quality control with the bathwater of anonymity? In fact, the editors of Atmospheric Chemistry and Physics presented evidence (based on their two-stage review process) that open review significantly increases the quality of articles a journal publishes (Fitzpatrick 2007:5)
AIP [AIP Advances]	AIP Advances is a fully open access, online-only community-led journal, covering all areas of applied physical science, including those topics not currently covered by the existing AIP journals. As an open access journal with advanced web 2.0 tools, the global research community will be able to find, share, evaluate, and discuss scientific research in new ways. AIP Advances puts relevant content and discussion tools in the hands of the community to shape the direction of the physical sciences.	Supplementary material - Appropriate items include multimedia (e.g., movie files, audio files, 3D rendering files), data tables, and text (e.g., appendices) that are too lengthy or of too limited interest for inclusion in the article. Links (URLs) in the online journal article allow users to navigate directly to the associated files. Note that subdirectories (folders) are not acceptable [OUTDATED]	

BG [Biogeosciences]	Biogeosciences (BG) is an international scientific journal dedicated to the publication and discussion of research articles, short communications and review papers on all aspects of the interactions between the biological, chemical and physical processes in terrestrial or extraterrestrial life with the geosphere, hydrosphere and atmosphere. The objective of the journal is to cut across the boundaries of established sciences and achieve an interdisciplinary view of these interactions. Experimental, conceptual and modelling approaches are welcome.	Public Peer-Review & Interactive Public Discussion … Supplementary material, such as data sets, animated visualisation, etc., should be submitted together with the manuscript for peer-reviewed publication.	
BJ [Biochemical Journal]	The Biochemical Journal is one of the world's leading life science journals, publishing over 4000 pages of high-quality scientific information every year. It is dedicated to the development of biochemical knowledge and features papers from all fields of biochemistry, cellular and molecular biology. The Biochemical Journal is published and distributed by Portland Press on behalf of the Biochemical Society.	The Biochemical Journal Online offers authors the opportunity to enhance their papers with the multimedia adjuncts (e.g. time-lapse movies, three-dimensional structures). These will be submitted to peer review alongside the manuscript. To submit a paper with a multimedia adjunct, attach the file when you submit your manuscript online. Preferred formats are QuickTime for time-lapse movies, PDB for structures and Flash for animated schemes. There is no extra charge associated with the publication of a multimedia adjunct online.	A new technological innovation: the Semantic Biochemical Journal. The software used, called Utopia Documents, transforms the content of the journal by dynamically linking documents to research data, enabling readers to interact with and manipulate the information in the journal's scientific papers more effectively. The software turns static images, tables, and text into objects that can be linked, annotated, visualized, and analysed interactively (BJ Wikipedia n.d.)
BMJ [The British Medical Journal]	The BMJ (British Medical Journal) is an international peer reviewed medical journal and a fully “online first” publication. Our "continuous publication" model means that all articles appear on bmj.com before being included in an issue of the print journal. The website is updated daily with the BMJ’s latest original research, education, news, and comment articles, as well as podcasts, videos, and blogs.	… Statements regarding ethics approval; informed consent from participants; funding; the role of the study sponsor in study design and the collection, analysis, and interpretation of data and the writing of the article and the decision to submit it for publication; the independence of researchers from funders and sponsors; and the access of researchers to all the data - all original research articles ...	
CCO [Computers and Composition Online]	CCO is the refereed online companion journal to Computers and Composition: An International Journal, now in its 26th year and currently published by Elsevier. Our goal is to be a significant online resource for scholar-teachers interested in the impact of new and emerging media upon the teaching of language and literacy in both virtual and face-to-face forums.	Submissions for Computers and Composition Online need to be web-aware, meaning that they not only use the World Wide Web as a medium but also take advantage of the benefits of this kind of publishing. Rhizomatic structures that disrupt traditional linear forms are welcome. Artful use of graphical interfaces and hypertext are also encouraged. Multimedia use, including digital video and audio, is also welcome.	Typically, Computers and Composition Online publishes two issues per academic year since our first BGSU-hosted issue in Spring 2003, a fact that is itself a testament to the role of the journal as an intellectual and experimental space for multimodal composing (CCO Editorial n.d.)

CEC [CrystEngComm]	Launched in October 1999, CrystEngComm has established itself as THE journal in which to publish cutting-edge crystal engineering research. The journal publishes Communications, Full Papers, Highlights and Letters. Its current impact factor is 3.84.	Key features of the journal … CrystEngComm allows research to be presented in innovative ways. Authors are encouraged to use colour, movies and animated graphics.	CrystEngComm was one of the first online-only chemistry journals to be published, with volume 1 being published in 1999. Initially articles were published online as soon as they were publishable and the journal did not publish articles in issues. However, in 2000 issues were introduced, and the journal was published monthly. (CEC Wikipedia n.d.)
CEL [Currents in Electronic Literacy]	Currents in Electronic Literacy advances digital literacies by critiquing and assessing the present state of the field. We construe electronic literacy widely to include literature, rhetoric and composition, languages (English, foreign, and ESL), communication studies, education, and pedagogy.	Currents in Electronic Literacy is a peer-reviewed journal that encourages submissions that take advantage of the hypertext and multimedia possibilities afforded by our World Wide Web publication format, as well as articles concerning the use of emergent electronic technologies. To this end, we gladly accept articles with graphics, sound, and hyperlinks submitted as HTML documents. We ask, however, that such submissions adequately consider reader-access issues.	
CITE [Contemporary Issues in Technology and Teacher Education]	The CITE Journal is an online, peer-reviewed journal, established and jointly sponsored by five professional associations (AMTE, ASTE, NCSS-CUFA, CEE, and SITE). This is the only joint venture of this kind in the field of teacher education. Each professional association has sole responsibility for editorial review of articles in its discipline.	It is an interactive electronic journal, capable of incorporating into its articles video, sound, animated images, and simulations, as well as ongoing dialog about issues that advance the field	The journal's online medium also allows authors to demonstrate the technologies about which they are writing, including video and audio segments, animation, virtual reality, Web links, and simulations … Third, the format of the journal is a departure from the traditional print journal. It is not simply a print journal distributed electronically. The content can be different. A paper can include video, animation, and audio, as well as links to external resources. In addition, the journal serves as a framework for ongoing scholarly discussions (Willis and Bull 2010:n.pag.)
CJO [Crystallography Journals Online]	International Scientific Union. Publishes 8 research journals (Acta A Acta B Acta C Acta D Acta E Acta F JAC JSR). Publishes major reference work International Tables for Crystallography (8 volumes). Promotes standard crystallographic data file format (CIF).	Artwork Guide: The aim of this guide is to help you prepare your electronic artwork for submission to IUCr journals. General points to consider. Preferred file formats. Figure sizing. Composite images. Fonts, labelling. Number formats. Colour. Cropping. Notes on particular types of figures. General guide to digital images. Checklist. Useful resource. FAQs	Raw data (image plate, diffractometer, film). Primary data (structure factors). Derived data (six-dimensional structural model)… (McMahon 2010:slide 4).

EIJ [Earth Inter-actions Journal]	Earth Interactions publishes papers that explore the interactions among the biological, physical, and human components of the Earth system.	A driving force behind the creation of this journal as an electronic journal was the desire to free authors of the constraints of the static printed page in the presentation of their research results. Dynamic and interactive components have already appeared as an integral part of articles published in Earth Interactions and this can only happen effectively if authors do not feel the need to also provide printable forms of this material in addition to the dynamic forms...	From the beginning, we were determined to have a journal that would do much more than reproduce electronically what could be printed on the page. Our goal has been to exploit the medium and go beyond the capabilities of the printed page. Earth Interactions authors are encouraged to include sophisticated graphics, data in electronic formats, and even useable computer code... (Holoviak and Seitter 1997:n.pag.)
EJGE [Electronic Journal of Geo-technical Engine-ering]	The primary objective of The Electronic Journal of Geotechnical Engineering is to create an open forum for rapid, interactive, peer-reviewed information exchange in Geotechnical Engineering, World-wide.	Web being the scene of the fastest changing technology, ... The authors should be prepared to use means of electronic transfer of text, image files, sound files, movies etc. that make up a paper. Authors will typically either "attach" the document to an email message or post, on a server they have access to, for the ejge Editorial Office to download. Papers may also be submitted on floppy disk (PC/compatible) along with image files etc. and mailed.	For instance, the Electronic Journal of Geotechnical Engineering (EJGE) announces the 'numerous advantages yet to be explored, such as live chat of the authors with discussers', but this has not materialized (Mackenzie Owen 2010:147)
ENCULTU [Encultu-ration]	Enculturation is a refereed journal devoted to contemporary theories of rhetoric, writing, and culture. We accept academic work in all media forms suitable for web-based publication, including conventional articles, hypertexts, videos, and multimedia projects. Submitted articles and projects are blind-reviewed and considered for publication on the understanding that they are not under consideration elsewhere. Traditional articles should be approximately 4000-6000 words long, reviews 1000-2000 words.	If you send an attachment, Word files in DOC or RTF are preferable. For hypertext or media projects you may initially submit a URL but will ultimately need to send a blind WinZipped version of the project for review.	
EPAA [Education Policy Analysis Archives]	EPAA/AAPE is a peer-reviewed, open-access, international, multilingual, and multidisciplinary journal designed for researchers, practitioners, policy makers, and development analysts concerned with education policies. EPAA/AAPE accepts unpublished original manuscripts in English, Spanish and Portuguese without restriction as to conceptual and methodological perspectives, time or place. We will not consider manuscripts submitted for publication elsewhere.	The Editorial Board may also consider other forms of academic communication for publication in the EPAA/AAPE BLOG such as: a) a 5-minute audio or video podcast linked to an article that explains the main points; b) short policy briefs entitled c) interviews with EPAA/AAPE author/s; d) oral translations of research findings in languages other than their publication language.	

FNS [Fertility and Sterility]	Fertstertforum.com was designed to fill the void in discussing the medical literature. ... Each year there is more and more to read yet less time and less opportunity to discuss what you read. With the pace of innovation accelerating exponentially many physicians and researchers find them selves feeling more and more isolated and falling more and more behind. For more than 60 years Fertility & Sterility has been the leader in reproductive medicine research. Now here you can leveraging the power of the internet, social media, and multimedia to connect all of us to fill in the void.	Original Video Articles should provide a significant contribution to the medical literature. They should include original data or provide a review of a subject. The visual demonstration of the topic is a key component and the video should demonstrate information beyond what would be in text alone. Video should NOT be a series of text only slides. ... In addition this will be the home site to view the multimedia content of F&S in one location including interviews with authors and original video articles as well as author video commentaries on their work. This multimedia content is also accessible through YouTube to ensure maximal free access.	For the last 200 years, medical publishing remained unchanged. Our solution accommodates non-print work through fully integrated multimedia, opens up a whole new form of learning, and allows readers to become part of an ongoing interactive discussion," says Dr. Steven Palter, the Video and New Media Editor of Fertility and Sterility. Dr. Palter, who developed the concept and spearheaded the project, says, "With this effort, we have bridged the gap separating the digital and traditional medical literature. This integration will lead to exciting new directions in research (Palter 2012:n.pag.)
FRONTIERS [Frontiers Journal Series]	The Frontiers journals are an interdisciplinary series of open-access journals bringing a paradigm shift in academic publishing. All our journals are community-driven, thought of by researchers for researchers, and provide an interactive, constructive and highly-principled peer-review.	The Frontiers Journal Series is an interdisciplinary tiered series of online journals, promising a paradigm shift from the current review, selection, and dissemination processes in academic publishing… Frontiers also publishes a number of e-documents, which can be purchased and downloaded on the website.	Introduced in 2007, Frontiers' peer review enables a collaborative dialogue online in real-time between authors and reviewers, with an associate editor as moderator. The final decision is based on consensus about objective issues between reviewers and editors, who are named on the final publication to acknowledge their valuable contribution and ensure transparency (FRONTIERS Forum n.d.)
IA [Internet Archa eology]	Internet Archaeology is an independent, not-for-profit, peer-reviewed e-journal for archaeology. It publishes articles of a high academic standing which also try to utilise the potential of electronic publication. The journal has been publishing online since 1996. ... The journal is a hybrid Open Access journal so some content is freely available. Everything else is currently subject to a low-cost subscription (pay once, access forever).	When thinking about your article structure, remember to use the benefits of the web. Consider more than a linear text with supplementary images. A web document doesn't necessarily have a beginning, middle and end. It might help to think in visual terms about the final structure.	Within an article in Internet Archaeology (intarch.ac.uk), the "first fully refereed electronic journal for archaeology," readers may search data sets using a variety of specialized query forms. Search results with relevant data are displayed in an HTML table. In some cases, links are provided from within tables to an interactive map. A reader can export data sets, including underlying geospatial data, to a local database or to a geographic information system (GIS) (McKiernan 2002:315).

IMR [In Media Res]	In Media Res is dedicated to experimenting with collaborative, multi-modal forms of online scholarship. Our goal is to promote an online dialogue amongst scholars and the public about contemporary approaches to studying media. In Media Res provides a forum for more immediate critical engagement with media at a pace closer to how we experience mediated texts.	Each weekday, a different scholar curates a 30-second to 3-minute video clip/visual image slideshow accompanied by a 300-350-word impressionistic response. We use the title "curator" because, like a curator in a museum, you are repurposing a media object that already exists and providing context through your commentary, which frames the object in a particular way. The clip/comment combination are intended both to introduce the curator's work to the larger community of scholars (as well as non-academics ...) and, hopefully, encourage feedback/discussion from that community.	... to submit proposals. The actual piece should include a 30-second to 3-minute clip, an image, or a slideshow accompanied by a 300 to 350 word response to/contextualization of the clip, image, or slideshow. In addition to curating your piece, you will be asked to engage with the other pieces presented that week as a means of fostering discussion and further fleshing out the individual topic in relation to the week's theme (IMR Call n.d.)
IPOL [Image Processing On Line]	IPOL is a journal of image processing and image analysis. Each article contains a text describing an algorithm and source code, with an online demonstration facility and an archive of online experiments. The text and source code are peer-reviewed and the demonstration is controlled. IPOL follows the Open Access and Reproducible Research models.	In case of positive answer, the submission is carried to a second step where the authors are invited to provide a final manuscript and software, following the IPOL manuscript guidelines and IPOL software guidelines. An editor can be assigned to help for the online demo part. The manuscript, software and demo are publicly disclosed in IPOL as a preprint.	
JAMS [Journal of the American Musico logical Society]	One of the premier journals in the field, the Journal of the American Musicological Society (JAMS) publishes scholarship from all fields of musical inquiry: from historical musicology, critical theory, music analysis, iconography and organology, to performance practice, aesthetics and hermeneutics, ethnomusicology, gender and sexuality, popular music and cultural studies.		With volume 67, no. 1, the ... JAMS, as it is familiarly known—has implemented new features planned and announced in 2012. The two most significant innovations are the new Digital and Multimedia Scholarship section ... and enhancements to the online version that include audio and video clips, color images, etc. (JAMS Review 2014:n.pag.).
JAR [Journal for Artistic Research]	JAR is an international, online, Open Access and peer-reviewed journal for the identification, publication and dissemination of artistic research and its methodologies, from all arts disciplines. With the aim of displaying practice in a manner that respects artists' modes of presentation, JAR abandons the traditional journal article format and offers its contributors a dynamic online canvas where text can be woven together with image, audio and video. These research documents called 'expositions' provide a unique reading experience while fulfilling the expectations of scholarly dissemination.	JAR's unique presentation of artistic research facilitates multi-modal exposition, thereby meeting the desire of artistic researchers to have their work displayed and documented in a manner that demonstrates a respect for modes of presentation. By introducing, together with the Research Catalogue, a standard for documentation, the Journal is responding to the international artistic and academic communities, which demand high quality referencing and documentation. Moreover, the Journal meets the need of art institutions such as museums, galleries and collections for artistic research to be more easily accessible.	

JASA-EL [Journal of the Acoustical Society of America Express Letters]	JASA Express Letters (JASA-EL) is devoted to providing rapid and open dissemination of important new research results and technical discussion in all fields of acoustics. It serves physical scientists, life scientists, engineers, psychologists, physiologists, architects, musicians, and speech communication specialists who wish to rapidly report the results of their acoustical research in letter-sized contributions. ... Letters are published online as they are accepted for publication, and also appear monthly as a section in the Journal of the Acoustical Society of America.	Multimedia files: A benefit of publishing in an electronic online journal is the ability to integrate multimedia files into both the published and archived articles. The online presentation of the paper allows for links to both audio and video clips directly from within the text of the article. The multimedia files submitted for JASA Express Letters (JASA-EL) will be reviewed as part of the peer review process and accepted for publication in much the same way as are 2-dimensional figures for traditional print journals.	
JoVE [Journal of Visualized Experi ments]	Journal of Visualized Experiments (JoVE) is a peer reviewed, PubMed indexed journal devoted to the publication of biological, medical, chemical and physical research in a video format.	JoVE publishes peer-reviewed video-articles documenting techniques and protocols in biological, medical, chemical, and physical research. Videos are generally between 10-15 minutes long and provide a detailed step-by-step description of the protocol to enable another scientist to easily reproduce the technique. Each article is accompanied by a written component, which contains introductory remarks, the protocol, representative results, discussion, and references.	
JSAH [Journal of the Society of Archi tectural Historians]	The online version, dubbed JSAH Online, will support presentation methods -- such as video, virtual modeling and digital mapping -- that academics have employed for some time, but could show off only in venues with the capacity to handle to multimedia exhibitions, such as live demonstrations and museum installations.	"The JSAH publishes two editions, on paper and online. The text content of the two editions is the same, but the online edition supports a greater variety of illustration types. … Digital Images, Caption, Video, Audio, 3 dimensional models, …"	Art history and architecture professors have long taught out of textbooks and held forth in journal articles with the caveat that to truly appreciate a painting or a building, you must see it with your own eyes. Scaled-down, two-dimensional renderings on a printed page simply do not do them justice. That may still be true. But the Society of Architectural Historians has developed a new platform for its online journal that it hopes will close the gap between reading about important architectural examples and experiencing them (Kolowich 2010:n.pag.)

KAIROS [Kairos]	Kairos is a refereed open-access online journal exploring the intersections of rhetoric, technology, and pedagogy. ... Kairos publishes bi-annually, in August and January, with regular special issues in May. Our current acceptance rate for published articles is approximately 10%.	Since its first issue in January of 1996, the mission of Kairos has been to publish scholarship that examines digital and multimodal composing practices, promoting work that enacts its scholarly argument through rhetorical and innovative uses of new media. … We publish "webtexts," which are texts authored specifically for publication on the World Wide Web.	We need online journals that aren't just copies of print journals. For example, JIME and Kairos are e-journals that really make use of the Web's potential as not just a cheap and easy alternative, but a better alternative. (Willinsky 2000:n.pag.)
LRR [Living Reviews in Relativity]	LRR is a solely web-based, peer reviewed journal, publishing as the name suggests, reviews of research in all areas of relativity. ... Journal Concept: ... a hypertext viewing environment. ... With a hypertext document, a viewer navigates information by following links on an "as-needed" or an "as-desired" basis. Thus, the path one follows through a hypertext document can result in an individual experience: self-selected and thus self-directed. Given this dynamic quality of hypertext, we expect Living Reviews to be used rather than just read. The awareness that we have users, not just readers, is a major principle guiding the design of Living Reviews.	Living Reviews journals go beyond the electronic dissemination of traditional print articles. All articles are readable online in HTML, integrated in a highly functional hypertext viewing environment. Sophisticated navigation support is offered for equations, figures, footnotes and references. Articles may include an unlimited number of colorful images, tables, movies, animations, or even program code and raw data. Additionally, all references cited in Living Reviews articles are collated in online searchable literature databases	LRR... offers the user extended navigation functionality with navigational links, reference links and a navigational sidebar. The sidebar ... gives access to a number of functions: besides a structured outline of the article several aggregate functions such as a 'compendium' (in fact the homepage of the journal) ... LRR makes a conscious effort to create a hypertext journal rather than an html-rendering of a traditional print journal (Mackenzie Owen 2010:156)
MTO [Music Theory Online]	Music Theory Online was launched experimentally in March 1993, after which issues 0.1 through 0.11 were published. Its permanent status was marked in January 1995 with the publication of Volume 1.1. MTO contains articles, commentaries on articles from previous issues, reviews, and essays all related to the field of professional music theory.	Graphics and musical examples. ... Preparing supportive files: Other File Types. Appropriate use of media formats such as MIDI and MP3 audio files, streaming audio or video (e.g., Quicktime), animation (e.g., Flash), and the like is welcome. Authors are welcome to discuss their ideas with the Editor in advance.	
NEJM [The New England Journal of Medicine]	The New England Journal of Medicine (NEJM.org) is dedicated to bringing physicians the best research and key information at the intersection of biomedical science and clinical practice, and to presenting the information in an understandable and clinically useful format.	NEJM launched a new website along with the full NEJM Archive in 2010. The new website gives users a deeper, broader, and more engaging experience through enhanced search and navigation, specialty pages, interactive elements, and a number of integrated multimedia features.	The New England Journal of Medicine (NEJM) has a highly interactive website showcasing new articles, but also providing a variety of audio and video publications, an image challenge that challenges readers to make correct medical diagnoses from displayed images, and 'dragand- drop' images that make it easier for readers to create PowerPoint presentations from published journal images (Shotton 2009:88)

NJP [New Journal of Physics]	New Journal of Physics is an online-only, open-access, peer-reviewed scientific journal covering research in all aspects of physics, as well as interdisciplinary topics where physics forms the central theme.	Video abstracts are a brand new content stream for New Journal of Physics, aimed at increasing yet further the visibility of our authors and their work. Through this video media authors can now go beyond the constraints of the written article to convey their research, and provide a new, enhanced user experience for the journal's global audience.	
PA [Palaeontologia Electronica]	Palaeontologia Electronica (PE) is an open-access, peer-reviewed electronic journal covering all aspects of palaeontology. PE began publishing in 1998 and has been indexed in the Science Citation Index since 2005. PE complies with ICZN and ICBN regulations for the electronic publication of valid taxonomic names...	Unlike traditional print-based journals, Palaeontologia Electronica will be highly graphical in both format and content. Authors will be encouraged to make use of colour in their figures and tables and to include high-resolution digital images as illustrations. Moreover, Palaeontologia Electronica will encourage active experimentation with animation, 2D and 3D modelling of morphologies, on-line access to databases, and the creation of on-line data analysis tools	
PHILICA [Philica]	Philica is an online academic journal accepting publications on any subject. Philica takes a completely revolutionary approach to the publishing and reviewing of academic research.	Formating Articles for Philica is very simple, and pictures and tables — and even music, sounds, and animations — can be included as part of the text.	
REIP [Revista de Enfermedades Infecciosas en Pediatría]	La Revista de Enfermedades Infecciosas en Pediatría es el Órgano Oficial de la Asociación Mexicana de Infectología Pediátrica (AMIP) y de la Sociedad Latinoamericana de Infectología Pediátrica (SLIPE), que pone a disposición del médico información innovadora y actual.		Multimedia was the least frequent of all characteristics. Only 3 journals have audio features, and only 4 journals have some form of video. Three of the more noteworthy cases were: ... (iii) Revista de Enfermedades Infecciosas en Pediatría (Mexico), where audio interviews present its authors and other researchers discussing current issues. (Cordóba and Coto-Solano 2008:n.pag.)
SRO [Sociological Research Online]	We publish fully peer-reviewed sociology looking at current issues. A purely online journal, we make use of new media and reach a wide and international readership. We also publish special sections and rapid response articles, which address key issues in the public arena.	Sociological Research Online encourages authors to make full use of the electronic media the journal publishes in, where possible attaching to articles, via hyperlinks, written field notes and numerical datasets, oral data and other oral material, and visual materials including video data.	Sociological Research Online (www.socresonline.org.uk) through its "Pinboard" feature (www.socresonline.org.uk/pinboard) provides a variety of methods by which readers can communicate with each other as well as with the journal editor. (McKiernan 2002:312)

SSP [Southern Spaces]	Southern Spaces is a peer-reviewed, multimedia, open-access journal. We publish articles, photo essays and images, reviews, presentations, and short videos about real and imagined spaces and places of the U.S. South and their global connections... Southern Spaces combines innovative scholarship about real and imagined spaces and places of the American South with the tools of digital media.	A digital publication, Southern Spaces provides a forum for innovative scholarship by taking advantage of the Internet's capabilities to deliver audio, video, images, and text and facilitating new ways of organizing and presenting research. ... Realizing that few scholars are experts in website design, we are eager to work with authors, photographers and videographers in the process of producing image, sound, and video files for submissions. We are committed to assisting scholars at varying levels of technological proficiency.	
TCR [Teachers College Record]	The Teachers College Record is a journal of research, analysis, and commentary in the field of education. It has been published continuously since 1900 by Teachers College, Columbia University.	TCR invites submissions utilizing all methods of inquiry, and all topics related to the field of education, broadly conceived, are welcome. Feature articles are considered for both online and print publication. Online features can take advantage of the variety of media made possible through electronic publishing, including the use of audio, video, complex or dynamic graphic displays, interactive sessions, performances, and other means to improve the communication of scholarly work. Features may be presented as a single article or in serial form.	To hear that "electronic journals revolutionize the way researchers report their work" - because the articles are interactive, multimedia, multi-linguistic, longer, and include the data - is to wonder whether it is not literally more of the same (Vrasidas, 2000,). It may be worth noting that Charalambos Vrasidas' online article in TCR is identified in a very un-journal-like-way with the day it was published, an ID number and the date I accessed it, rather than volume and number... (Willinsky 2000:n.pag.)
VECTORS [Vectors]	Vectors maps the multiple contours of daily life in an unevenly digital era, crystallizing around themes that highlight the social, political, and cultural stakes of our increasingly technologically-mediated existence. As such, the journal speaks both implicitly and explicitly to key debates across varied disciplines, including issues of globalization, mobility, power, and access. Operating at the intersection of culture, creativity, and technology, the journal focuses on the myriad ways technology shapes, transforms, reconfigures, and/or impedes social relations, both in the past and in the present.	Rather, Vectors is realized in multimedia, melding form and content to enact a second-order examination of the mediation of everyday life. Utilizing a peer-reviewed format and under the guidance of an international board, Vectors features submissions and specially-commissioned works comprised of moving- and still-images; voice, music, and sound; computational and interactive structures; social software; and much more. Vectors doesn't seek to replace text; instead, we encourage a fusion of old and new media in order to foster ways of knowing and seeing that expand the rigid text-based paradigms of traditional scholarship. Vectors features commissioned multimedia works produced through collaboration between scholars and the Vectors creative team.	Since Vectors launched in 2005, many more scholars have the capacity to produce multimodal research, and the number of venues for such work has slowly expanded. ... Vectors continues to offer a platform for experimenting with the forms and potentials of online scholarship. In conjunction with its sibling project, the authoring platform Scalar, ... Vectors will continue its role of pushing the boundaries of research in the arts, humanities and social sciences (VECTORS Editorial n.d.)